MOTIVATION OF BEHAVIOR

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THE FUNDAMENTAL DETERMINANTS OF HUMAN AND ANIMAL ACTIVITY

BY

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PREFACE

Throughout the preparation of this volume I have been guided by a central purpose rather than by any fixed and predetermined point of view. This purpose is to examine the determination of human and animal behavior in its varied aspects. From one standpoint the study of motivation is concerned with energetics, *i.e.,* with those conditions which evoke specific bodily movements and which regulate the general level of activity. From another standpoint the study is an investigation of the factors which regulate and control the course of activity. This includes all those activities designated by psychologists as purposive behavior. From still another point of view our problem relates to the development of motivating factors: it is a genetic study of the change and interplay of interests, desires, habit organizations, and similar determiners of behavior.

The stream of contemporary psychological thought has many cross currents. The impartial observer can readily detect these trends of opinion in the varied researches upon motivation. Some psychologists stress the conscious experiences of individuals and are concerned with the rôle in human behavior of desire, goal-awareness, pleasant and unpleasant feeling. Others rely upon the objective facts of human and animal behavior, which they explain by reference to bodily processes, thus resolving the study of motives to a branch of physiological psychology. Again, some currents in the stream of thought move toward a biological explanation of behavior; others toward interpretation in terms of social factors. Some move toward environmentalism; others toward explanation in terms of heredity.

I have tried to assume the rôle of an impartial onlooker, that of the proverbial man from Mars. An investigation of motivation presents so many aspects of the subject to the student that a single description would be misleading; the strict adherence to any fixed viewpoint would give a badly distorted impression. In so far as I have a bias, that has been expressed at the close of Chapter X.

The book is intended for students who have taken an introductory

college course in psychology. It has been used by me as a textbook for a course upon the problems of motivation. The volume will be found serviceable as a collateral textbook or a reference work in courses dealing with human and animal behavior, and with educational, social, and applied psychology. It will also be useful in those more specialized courses upon some single topic such as learning or the affective processes. The book, it is hoped, will aid all students of psychology who are seeking a scientifically sound, factual account of the motivational bases of human and animal behavior. Finally, to the educator, political scientist, economist, historian, sociologist, lawyer, minister, social worker, and others who are concerned with the activities of the human individual, this book aims to present a scientifically sound account of the fundamental sources of human conduct.

The book is factual in its approach. Most of the experiments upon which the volume is based have been carried out during the past ten or fifteen years. Speculation and theory have been strictly subordinated to the presentation of laboratory findings. A final dogmatic statement of the principles of motivation at the present time would be premature, but the student is invited to formulate hypotheses and to criticize them in so far as he is able to do so.

The bibliography found at the end of each chapter lists topically the works referred to in that chapter, plus a few other titles which will be found useful in studying the field. Inasmuch as we have had to select materials from a large body of literature, the lists of references should not be regarded as complete bibliographies, but only as the more pertinent guides to the available sources. The questions and exercises presented at the close of the text are intended for use by the beginning student, in study and review.

I am indebted to the editors of the following psychological journals for permission to reproduce numerous illustrations: *American Journal of Psychology; Archives of Psychology; Comparative Psychology Monographs; Journal of Comparative Psychology; Journal of Experimental Psychology; Psychological Monographs; Psychological Review*. Several long quotations have been made with the permission of the authors and of the following publishers: Harcourt, Brace and Co.; Henry Holt and Co.; Houghton Mifflin Co.; Missouri Historical Society; Charles Scribner's Sons; D. van Nostrand Co.

For a critical reading of parts of the manuscript prior to publication and for valuable constructive suggestions I am indebted to the following psychologists: E. E. Anderson, J. F. Dashiell, A. W. Kornhauser, S. Rosenzweig, and C. P. Stone. My heaviest obligation is to my wife, Josephine Kennedy Young, who has read the manuscript painstakingly and made many helpful suggestions for its improvement.

Paul Thomas Young

Urbana, Illinois
January 1, 1936.

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CHAPTER I

THE PROBLEM

> "Motivation, instead of being a special problem, a rather interesting hobby for those who wish to leave the psychological highroad, is a *central* problem in relation to which others must be seen."
>
> —GARDNER MURPHY

All behavior is motivated. Getting out of bed when the alarm clock rings, brushing the teeth, shaving, selecting the day's necktie, ordering rolls and coffee or ham and eggs from the menu card, picking up a paper to read the news—these everyday activities are all causally determined. You take them for granted, generally being unconscious of any motive determining what is being done. Nevertheless a definite motivation is invariably present.

You resolve to make an apology to your manager, but when confronted with his austere face postpone doing so. You decline an invitation over the telephone, and later, upon learning that a popular social leader has accepted the same invitation, you regret your decision of the moment. You are in doubt as to whether to walk or ride to the office. You deliberate: walking saves gasoline and is healthful; riding saves time. When you discover that some other member of your family needs the car you suddenly decide to walk. This decision is motivated by considerations which are balanced one against another.

To the layman the analysis of motives is the attempt to answer the question "Why?" "Why did Johnnie steal the apples?" "What wish or desire caused Mary to run away from school?" "What purpose or motive did the criminal have for shooting his victim?" "What led Jones to decide upon teaching as a profession?" "Why . . . ?" Such questions call for answers and challenge the psychologist.

The average man today is aware that purposes and desires lead him to act; he imputes similar conscious processes to other individuals to help him understand and appreciate their conduct. If he has read a

little psychoanalysis, he knows that unconscious motives influence human behavior. Often the reasons which an individual gives for his conduct are nothing but the barest rationalizations—defense reactions, though he may not realize it—which conceal some genuine but irrational determinant of conduct.

Better to understand human behavior, better to gain insight into and explain the actions of one's self and others, the student turns to psychology and to the study of motivation. Practical considerations also lead to this study. We all desire to influence and control human behavior—our own and that of others.

A student once applied what he had learned about motivation to his work as a salesman, and before the semester was over had won a national prize in salesmanship. Credit belongs to his energy, his friendly manner, his aggressive personality, his ability to sell, and certainly in part to his knack of applying scientific motivational principles to the everyday task.

The aim of the present book is not to create better salesmen, advertisers, and politicians. There is little doubt that many of the principles of motivational psychology are of great practical importance, but mere knowledge is not enough to achieve results. Knowledge of motivational psychology will not necessarily make one a master of men, any more than knowledge about the construction of a violin will make one a virtuoso. The art of controlling behavior has to be acquired, as does any other art, by diligent practice.

THE PRACTICAL IMPORTANCE OF MOTIVES AND INCENTIVES

In every situation that vitally concerns human behavior questions of motivation arise. Before we analyze the problem of motivation within psychology we will examine a series of materials which richly illustrate motivational factors in their concrete settings.

Motivation in the School. Two quotations from the Wilsons' book *The Motivation of School Work* present a contrast and a moral which scarcely need any comment.

If a child is constantly held to work in which he has no interest, he gradually develops the habit of divided attention, neglect of the work in hand, pretense, and activity only sufficient to satisfy the teacher or the one imposing the task. He weakens his moral nature, he tends constantly toward deception and hypocrisy. No experienced

teacher can have failed to notice this tendency. John is not interested in his grammar. The work is upon the conjugation of the verb. It is abstract work. It is difficult. It makes no appeal to John. However, he is held in line by the threats of his teacher, the fear of failing of promotion, the coaxing and admonition of his parents, the dread of the disapproval of his classmates, and other like considerations. The task in hand continues to be abstract and uninteresting. He sees no use in it. In itself it makes no appeal to him. Nevertheless, John conforms,—but how? Does he throw his whole soul into the work, seeing its value and determining to profit by it? Far from it! He gives just enough attention and energy to satisfy the teacher, parent, and classmate. He thinks of the ball game while trying to study his grammar. Again and again he finds his attention drifting, and again and again he pulls himself together for the work before him. When the class is called, he is not prepared, but defends himself, if discovered, by saying that he put in full time upon the assignment. Anyway, he is about as well prepared as the others. He steals furtive glances at his open book, listens for whispered promptings from his classmates, "dodges and ducks," and comes away from the recitation more convinced than ever that the whole thing amounts to nothing.

And now in sharp contrast follows a picture which shows how school work moves forward when adequately motivated. The quotation describes a May-day party which was used to good advantage educationally.

A great many very interesting real problems grew out of the decision of a third-grade class to give a May-day party to which their mothers were to be invited. Under the skillful management of the teacher, the children carried the responsibility for the party from its inception to its completion. They wished to earn the money necessary to defray all expenses and to manage the development of the program, the reception of the guests, the presentation of the entertainment, and the serving of the refreshments.

During the progress of the work, and following it, the teacher based much of her school work upon the problems the children found it necessary to solve. Problems solved during the manual training and art lessons grew out of the need for a May basket and a program for each guest. Many problems in arithmetic arose in estimating the cost of the party and in figuring up the purchases made. These were met and solved in the arithmetic lesson. The following,

selected from the teacher's list as reported to her superintendent, are typical:

1. There are 50 pupils in our room. If each pupil comes and each pupil's mother comes, how many will be at our party? How many will it make if we also invite the 4 supervisors who teach us?
2. Eight mothers replied to our invitation that they cannot come; how many should we expect at our party then?
3. How much ice-cream must we get to serve 96 guests? If a pint of ice-cream will serve 4 persons, 1 quart will serve —— persons. One gallon will then serve —— persons. It will, therefore, take —— gallons to serve 96 persons.
4. One gallon of ice-cream costs 80 cents, so 3 gallons will cost us \$——.
5. If we serve each person 2 nabiscoes, we will need —— nabiscoes.
6. There are 50 pupils in our room. If each child earns a nickel, we will have \$——.
7. Our teacher gave us 50 cents she made. Our \$2.50 and her 50 cents will give us \$—— to spend for refreshments.
8. Our ice-cream will cost us \$2.40, so we will have —— cents left to buy nabiscoes.

Many additional problems were met in determining the number of programs, dishes, spoons, napkins, and chairs which would be needed for the party. Many of the problems were different from those the pupils had had in the arithmetic in use. Many original ways of solving the problems were therefore developed.

Interesting compositions were written in which each told how he earned his money and in which the success of the party was recorded. Notes were written asking the first grade to make colored-paper chains with which to decorate the room, another grade to make programs for distribution to the guests, and other grades for flowers to decorate the room and for chairs to seat the guests. Finally a formal invitation was written to each guest invited. After the party was over, all who assisted were thanked in a written note or in a personal message borne by some pupil. A gentleman who contributed some paper napkins received a very courteous and detailed note of thanks.

The following are specimens, chosen from a large number reported, which illustrate the kind of writing the children did. The

occasion for each bit of writing is evident from the preceding explanation:

THE WAY I EARNED MY NICKEL

I earned my nickel by not crying for five days, but I could hardly keep from it.

HOW I EARNED MY NICKEL

I said to mama, "I want to earn a nickel." She said, "If you will wash the dishes this noon, I will give you a nickel." So I went right to work and did them. She gave me my nickel. . . .

When the party was over and all the courtesies due had been attended to, teacher and pupils alike felt that they had not only enjoyed having the little social, but that they had had an infinitely more valuable series of lessons in music, drawing, writing, language, and arithmetic than they could have gained in the same time merely through the faithful use of their textbooks in the usual way. They really felt that they had actually used them more, although in every case it had been to get help in solving some problem met in planning for the party. Every child was eager to have each thing exactly correct, and so he gladly used any book or got any lesson that would help in completing the plans for the social.

In a highly significant report upon incentives to study, Crawford writes:

President Hadley once commented on how much easier teaching would be if we could only elevate study to the level of extra-curriculum activity. This characteristic epigram strikes profoundly at what the writer feels is the root of our present-day teaching problem. Just that is what our course of study needs. In an age which colleges have taught to be curious and skeptical, reasons for studying are no longer to be taken on faith. We encourage students to ask the why and wherefore of events; we teach them to be guided by logical inferences from observed phenomena; we caution them to beware of experimental errors and of conclusions based on hearsay —and then we berate them for needing to be shown *why* after all they should take a more lively interest in Classical Civilization or the Mind-Body problem than in the ability to kick a field goal from the forty-yard line. As Richardson has said, the coach is unique in

having "a class painfully intent on getting what he has to offer; not sixty per cent of it, but all of it."

We are not attempting here to uphold the present overemphasis on such activities, but simply to point out that a student's incentive in such directions is readily aroused because there he can *see his objectives*; where he is going in the classroom, or what the whole curricular picture means, too frequently is "seen through a glass darkly." In fact we must recognize the influence of such specific motivation factors upon American college students whether we like it or not. . . .

Purpose, for the student, is apparently so lacking in our present-day curriculum that the course of study in itself offers largely insufficient positive incentives to many of our potentially ablest and most worth-while undergraduates.

This would seem to justify a warning not lightly to legislate against such sources of motivation as we have, however we may regard them educationally—at least until we have successfully substituted better ones. What goal, indeed, are we making sufficiently clear and magnetic to our college student for him to be driven by a higher form of urge than those we have just discussed? Student activities have evolved as an outlet for the energy and ambition of those to whom the present purposeless, disoriented course of study frequently offers, of itself, an entirely inadequate appeal. To curb the activities without correcting the evil from which they sprang—curricular sterility—might but drive undergraduates to find other and less desirable means of diversion.

Motivation in Industry. It has been found that the industrial worker may be spurred on to a higher level of output by the use of special incentives. The significant work of Kitson at the Lake Side Press, Chicago, illustrates well this principle.

Kitson first determined the output of forty experienced hand compositors and developed a rating scale which was based upon the number of lines of each kind of type an expert could set in an hour. The level of an expert was taken as 100 per cent, and 75 per cent of this standard was regarded as a fair day's work. Every compositor in the plant was paid a flat hourly rate whether he reached the 75 per cent point or not; and every man was told that as soon as he exceeded the 75 per cent point he would receive an additional sum. The amount of this bonus depended directly upon the number of units of work accomplished.

An objective measure of output gave definite records of performance both before and after the introduction of the bonus incentive. These records were kept for a period of twenty weeks after the introduction of the bonus system, and thereafter production scores were obtained at intervals of three months for a year. The change in output under the new system was carefully watched.

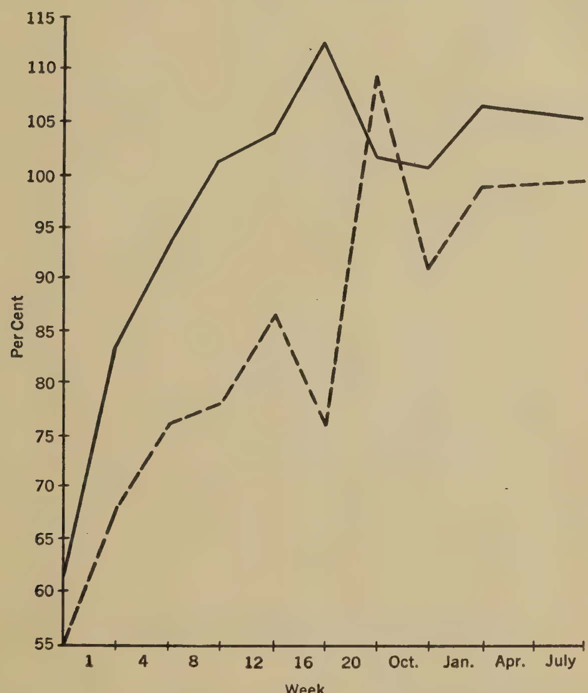


FIG. 1. CHANGE IN THE PRODUCTION SCORES FOR TYPESETTING, IMMEDIATELY FOLLOWING THE INTRODUCTION OF A BONUS SYSTEM. (*After Kitson.*)

Solid-line curve shows the production score for the better half of a group of compositors; dash-line curve shows the same for the poorer half of the group.

The result of the experiment was an average increase of production score from 59 per cent to 105 per cent. Not only did the general average increase but also individual output increased steadily during the first twenty weeks, in every case but one. The single exception was a compositor who started with the highest initial record (102 per cent) and declined two units. Apart from this exception, individual workers increased from 2 per cent to 110 per cent, the average

gain being 38.9 per cent (average deviation, 19.3). It is significant that the average production score for the group of forty compositors had reached the 75 per cent mark by the end of the fourth week.

In analyzing his results Kitson divided the workers into two groups on the basis of skill. Figure 1 presents the results graphically. At the end of the twentieth week the averages for the two groups were very different, but after that time the low group continued to gain and the high group declined slightly. At the close of the experiment the two groups appeared to be approaching a common level markedly above the initial one. The curves show that the earlier effect of the bonus system was to increase individual differences, spreading the good and the poor groups farther apart, but the later effect was to level off these differences, bringing the groups closer together.

The years of experience for the two groups of workers used in the experiment averaged about the same. Kitson states that those with long experience did not, because of it, turn out more work than the others. In fact, under the incentive system they turned out less work. The experienced men were older and probably slower in their movements than the others; further, the older men, Kitson believes, were firmly settled in habits of work, some of which were inefficient. The younger men, on the other hand, did not have bad habits of work so firmly established, and could change with greater ease. The increase in speed in the typesetting came about with the elimination of wasteful methods of work and acquisition of economical ones.

Upon this interesting study several comments should be made. First, one must not assume that the experiment gives univocal evidence of economic motivation alone, because in addition to the monetary reward the plan involved keeping of production records, knowledge of results by the workers, competition with one's own record and with that of other workers, a definite objective goal. These latter factors of themselves are known to be incentives quite apart from monetary reward, as we shall see. Second, one might naïvely assume that the introduction of a premium system in a commercial enterprise induces sudden "efforts of will" and that the latter produce an immediate rise in output. Such was not the case in this experiment. Despite apparently vigorous attempts of the workers to attain a maximum, it was a matter of weeks to months before

wasteful methods of work were eliminated and more effective methods discovered and put into operation. The learning was a gradual process—a slow change from one level of production to another—brought about after the motivation was varied. Third, the charge of labor organizations that a cash premium system speeds up the workers at the cost of injury to their health cannot, according to Kitson, be proved in this case. The higher level of performance was maintained for two years with no indication that the workers were seriously overtaxing themselves.

In situations in which the individual is already performing at a level close to his maximum, as in the sweat shops where the "piece work" system of payment exists, increased motivation might lead to still greater efforts with resulting injury to the worker's health; but when energy expenditure is low and inefficient methods are being used, the production level can readily be raised through special incentives, with no harm to the worker.

Motivation within the Individual Life. It is commonly known that our conduct is determined by desires, purposes, fears, and similar factors. Even unconscious motives derived from early childhood influences determine present behavior. Basic motives are well revealed in the case histories of individual lives. Several samples are quoted below for illustration; although the examples are drawn from the field of abnormal psychology, they illustrate certain principles which are valid for normal behavior as well. The mechanisms illustrated in the following accounts will be discussed in detail in Chapters IX and X.

(A) Phobia of Running Water. The following case of fear of running water originated in a childhood experience which was strongly repressed. The example is quoted from Bagby's *Psychology of Personality*.

A young woman of good heredity developed during her childhood a severe phobia of running water. She was unable to give any explanation of her disorder, which persisted without noticeable improvement from approximately her seventh to her twentieth year. Her fear of splashing sounds was especially intense. For instance, it was necessary for her to be in a distant part of the house when the bathtub was being filled for her bath, and during the early years it often required the combined efforts of three members of the family

to secure a satisfactory washing. She always struggled violently and screamed. During one school session a drinking-fountain was in the hall outside her classroom. If the children of the school made much noise drinking, she became very frightened, actually fainting on one occasion. When she rode on trains, it was necessary to keep the window curtain down so that she might not see the streams over which the train passed. These are some of the more typical features of her reaction to running water. It can be imagined that her life was very seriously interfered with by the disorder.

During the young woman's twentieth year, an aunt came to visit at her home. This lady had not seen her niece during the whole period of thirteen years through which the phobia had persisted. She was met at the station by the mother of the girl who gave a brief account of her daughter's condition. On arrival at the home, the aunt met the girl at the front steps and said immediately, "I have never told." This statement served to provoke a recall of the conditions under which the fear of running water had been established. The fact is doubly interesting because such determined efforts to stimulate her memory had previously been made by her parents and by various physicians.

The mother, the aunt, and the little girl—she was seven years old at the time—had gone on a picnic. Late in the afternoon, the mother decided to return home but the child insisted on being permitted to stay for a while longer with her aunt. This was promptly arranged on the child's promise to be strictly obedient and the two friends went into the woods for a walk. A short time later the little girl, neglecting her agreement, ran off alone. When she was finally found she was lying wedged among the rocks of a small stream with a waterfall pouring down over her head. She was screaming with terror. They proceeded immediately to a farm house where the wet clothes were dried, but, even after this, the child continued to express great alarm lest her mother learn of her disobedience. However, her aunt reassured her with the promise, "I will never tell." So at last they returned home and to bed. As the older woman left the next morning for a distant city, the girl had no one in whom she could confide. On the contrary she repressed all thought of her accident and presently she was unable to recall the facts even when a serious effort was made to have her do so. This is the most striking feature of a phobia, its ostensible lack of explanation.

It has already been explained how recall was ultimately secured

after thirteen years. It may be added that after the memory had been reinstated, the young woman found it possible to approach running water without discomfort and gradually the special adjustments of conduct, which the phobia had necessitated, disappeared.

(B) **Inferiority Complex.** The next illustration, also borrowed from Bagby, shows how a sense of personal inferiority developed and operated as a motivating factor within the personality of a young woman.

While our primary interest is the psychological development of a certain young woman, her mother's personality requires a brief preliminary comment.

The mother had married imprudently, and soon her lack of social position became a source of very keen distress to her. The humiliation was increased by the fact that her sister's agreeable situation offered a sharp contrast to her own. It is, therefore, not surprising that, when a daughter was born and while the child was still an infant, the mother began to develop elaborate phantasies. Her little girl was to grow up to be an utterly charming person who would marry the most remarkable of men. It was to her great disappointment then that she discovered that her daughter was not pretty and not at all clever. She reacted curiously to this threat to her hopes. She was infuriated and began a remarkable system of persecution. She regularly told her child that she was an ugly duckling and she punished her without justification and with great severity. Perhaps, we may look upon this exaggerated rage reaction as transference from a blocked emotional response to her husband. At any rate, it was under this unnatural regime that the daughter's personality developed.

The child became very timid in her relations with all adults, and she was not permitted to associate with any of the children of the slums in which she lived. Accordingly, she developed ideas of personal inferiority but failed to secure adequate defense reactions, though she did become seclusive and was over-absorbed in play with her dolls. These general tendencies persisted until she reached the age of fifteen, at which time she began to improve in personal appearance. Her mother's exalted matrimonial hopes were promptly revived, and new plans of securing the attractive husband were set into operation.

It proved possible to attract some young eligibles to the house.

On the first of these occasions the mother ushered the caller into the parlor with considerable ceremony and, ostensibly departing, actually concealed herself behind the curtains at the door. Later, after the young man had departed quite unimpressed, she undertook to point out some of the defects of her daughter's technique. She said, in part, that the girl was not only unduly formal in manner but that her conversational efforts were more stupid than could be expected of a normal person.

Several young men called after this but the girl, knowing that her mother was behind the curtain, thought of things to say, criticized them herself, and remained silent. The young men struggled through part of the evening and went away never to return. This confirmed the girl's lack of confidence in herself and the drive of her complex became more intense.

Fortunately, at this time, the family finances got into such a condition that the girl had to secure employment. She found a position for which she was fitted by a business course and, with the intense drive of her fear, she displayed such energy that she succeeded. Psychologically considered, her employment removes her from the sources of stimulation to her complex. This is a seclusiveness defense. Secondly, the attitude of her employers and co-workers is favorable to her. Finally, she rationalizes in two ways. She says that the institution of marriage is slavery for women and that the young men and women of the day are utterly trifling and unworthy of the attention of a serious and industrious woman.

(C) **Conflict: Fear *versus* Sense of Duty.** In one of the cases described by McDougall from his rich medical and psychological experiences during the Great War, a severe mental conflict developed between a fear reaction and a sense of religious duty. The illustration follows:

A young man, preparing for the ministry, had been for some years a member of the lay brotherhood. He had continued as a lay brother because he felt that he was not yet ready for the graver responsibility; a fact which indicates his high degree of conscientiousness. Soon after the outbreak of the war he volunteered for service, though he was very far from Europe, and joined the Medical Corps. He was soon sent to the front as a stretcher-bearer. There he found that the explosion of shells provoked in him uncontrollable fear; every time a shell exploded near him, he was moved by an uncon-

trollable impulse to dash for cover. He was much distressed by his liability to fear and his inability to control its impulse; he struggled hard to get the better of his weakness, hoping that he would be more successful as he disciplined himself and that, on repetition of these experiences, familiarity would weaken the force of the impulse. But no improvement came. He had been taught to believe, and he did believe, that, if he prayed for strength, strength would be given him. And so he prayed earnestly and often for such increase of strength. It was, or seemed to him, a crucial test of his religious beliefs. He was asking for no miraculous intervention in the physical order of things; he was praying for strength to enable him to do his duty, to succour comrades stricken in what he believed to be a noble and righteous cause. He felt that his prayers were wholly reasonable, that his motives and his aim were wholly good. Surely, God would help him! But there was no answer to his prayer; no strength came. Rather he went from bad to worse. He felt that his religious belief was crumbling away; and his distress was accentuated. He could sleep but little; and he became emaciated and increasingly "jumpy" and less able to do his duty; until at last a merciful officer sent him to hospital. There he found little relief; for, though he no longer suffered the frequent shocks of fear, the inner conflict continued. He still desired strongly to do his duty as a soldier; but he had no hope of overcoming his shameful fear impulse. Thousands of men in similar situations were breaking down with all sorts of neurotic disabilities, paralyses and amnesias, and so forth. His conflict found no such partial solution and relief; for his training had accustomed him to search his own heart, to understand and frankly examine his motives; therefore the conflict took place in the open, on the plane of full consciousness. He had no positive symptoms of functional disorder; he wandered restlessly about the hospital seeking to make himself useful, his emaciated face bearing an expression of intense distress; his mind the seat of an unceasing conscious conflict. On almost every occasion that I came near him, he would draw me aside and beg earnestly to be sent back to the front. He was the victim of a conflict of which there could be no solution so long as the war continued; there could be no peace of mind for him, unless he should be fortunate enough to receive a severe or fatal wound. I have no doubt of his entire sincerity, when he expressed the desire to find death on the battlefield.

McDougall comments that the case is unusual in that there is absence of repression and neurotic symptoms, in spite of the severity and long continuance of the conflict. Many similar conflicts are solved by repression—nature's crude way of dealing with conflict—which results in the development of neurotic symptoms.

MOTIVATIONAL INCREMENTS AND DECREMENTS

A *motivational increment* is an increase in the speed, strength, precision, or other measurable attribute of performance which depends upon conditions to be defined as motivating. A *motivational decrement* is a decrease in the same variables dependent upon motivating conditions.

To illustrate motivational increments and decrements a few typical experiments have been selected. They show the dependence of reaction time, muscular strength, score in an intelligence test, and rate of learning, upon motivating conditions. A final illustration shows that changes in the effectiveness of a given motivation occur with the passing of time.

Incentives and Reaction Time. It is common knowledge in psychology that reaction time varies with the preparatory adjustment of the subject. When a subject is prepared to move as quickly as possible the reaction time, on the average, is shorter than when he is set to perceive the stimulus-object.

In an interesting experiment Johanson has shown how the reaction time varies with certain motivating conditions. In this study the subject rested his finger lightly upon a telegraph key; he was instructed to react by pressing the key when the sound was heard. The apparatus which was provided for measuring the time between stimulus and response was screened from the subject's view.

There were three experimental conditions designated as *normal, incentive,* and *punishment.* Under *normal* conditions the subject received no information about the speed of his reactions. Under *incentive* conditions the subject worked with knowledge of his results; his previous reaction time was told him before the "ready" signal. For example, he was told, "Your time was 150 sigma,"* or simply "150." Under *punishment* conditions the subject was given

* One sigma (σ) = 0.001 second.

an electric shock for slow reactions. This shock was delivered through two small copper plates on the knob of the telegraph key. Instructions when punishment was used were as follows:

This time you will react as before to the sound stimulus. Use the same movement in releasing the key, only be sure that in holding the key down you have had a finger on each of the two copper plates. You will receive an electric shock only when you do not

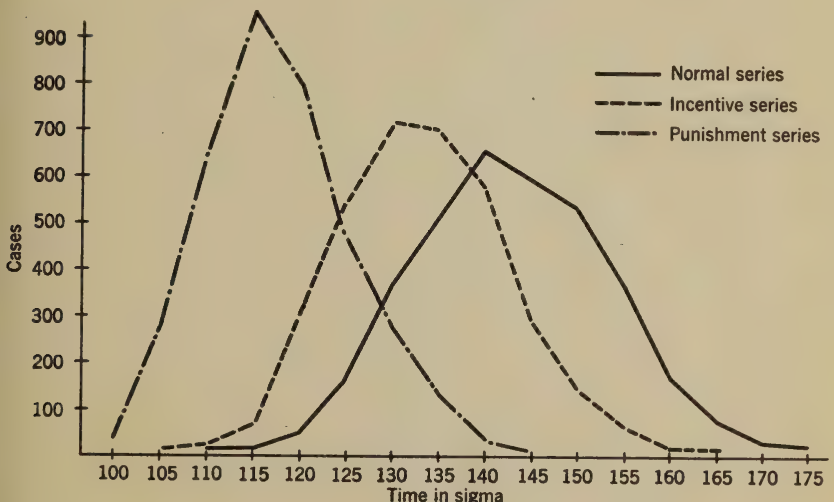


FIG. 2. DISTRIBUTION OF SINGLE REACTIONS UNDER DIFFERENT MOTIVATING CONDITIONS. (*After Johanson.*)

The curves show how the average speed of reaction can be increased by giving the subject definite knowledge of his reaction time, and by using an electric shock as punishment.

react quickly enough. That is, if you begin to slow down and take long to react you will not be able to get away from the key without being shocked. A shock means that you are not doing as well as you have been doing and that your reaction-time is long. Avoid the punishment by speeding up and by maintaining that speed.

Reactions were taken under each of the three conditions, the conditions being rotated from day to day to balance the effects of habituation and fatigue. The results, presented graphically in Fig. 2, show that the incentive series gave shorter reaction times than did the normal, and the punishment series the shortest of the three. The averages and probable errors were:

	Normal	Incentive	Punishment
Av.	143.9σ	135.0σ	122.3σ
P.E.	0.45σ	0.20σ	0.67σ

Johanson interprets the result in terms of keenness of "attention." This view is indicated by the fact that premature reactions were more frequent with the faster reactions in the ratio 1:3:6, respectively, for *normal*, *incentive,* and *punishment* groups. By "attention" he doubtless means the preparatory adjustment of the subject to his task, which varies with the experimental conditions. Johanson's results are interesting in themselves, quite apart from his interpretation of them.

Incentives and Muscular Strength. In a careful investigation on recovery from muscular work, Crawley made some important observations upon incentives. Four men were used as subjects. The general plan of the investigation included two work periods separated by a two- or four-minute interval of rest. The conditions of the second work period were constant throughout the experiment, but those of the first were systematically varied to see what effects such variation might have upon the performance during the second period.

The subjects' work was the lifting of weights by the arm and leg muscles. In using the arm muscles each subject stood, and a padded trough, for steadying the upper arm and preventing side movements, was adjusted to suit his height. The forearm was then alternately flexed and extended to the beat of a metronome. When work was done with the leg muscles the subject seated himself on a low chair in front of which was a guarded track with a rubber-tired, ball-bearing carriage, similar to a roller-skate, to move in it. The foot and ankle were strapped to this carriage, and by means of a pulley-rope arrangement an outward thrust lifted the weight and an inward movement released it. The weights for arm and leg work were varied from series to series. The up-and-down movements of the lifted weight were recorded on a kymograph drum by means of a cord and reducing lever.

Work was done with the arm movement in the morning and with the leg movement in the late afternoon of the same day. The arm work took approximately ten minutes, including both work periods and the rest interval; the leg work took ten to twenty-five minutes. In both cases work was continued to the point of actual exhaustion.

In certain *no-incentive* series the kymograph drum was screened from view and work was done under the general instruction to carry on with the movements until tired out. In *incentive* series the screen was removed and the subject could see the moving lever as it recorded every stroke; he thus worked with complete knowledge of his results. In some of the tests further motivation in the form of a goal was introduced. The goal was a horizontal line drawn on the kymograph paper above the marker to indicate the extreme limit of the subject's previous performance during the *no-incentive* work. This line spurred the subject to his maximum performance; it introduced a form of self-competition which was entered into actively and positively.

During rest periods the subjects walked about the laboratory. At the start of the second work period the screen was replaced for the *incentive* series, making the recording invisible. Thus the conditions for the second work period were identical for the *incentive* and the *no-incentive* series.

Crawley's results permit of several instructive comparisons. It is an interesting fact that with knowledge of visible results and a definite visible goal the subjects almost always exceeded their *no-incentive* record. There is no doubt that self-competition with knowledge of results produced greater amounts of work from the subjects than were produced in the absence of these motivations. Every subject showed some positive gain in the *incentive* series relative to his results in the *no-incentive* series.

But the following additional point is important: the greater the amount of work done in the first work period the smaller the amount done in the second. Extra exertion on the part of the subjects during *incentive* conditions was followed by a noticeable letdown in the second work period. In other words, additional incentive during the first work period produced more work while

the incentive was operative, but there was a subsequent decrement and relatively less was produced in the second period.

Crawley summarizes his findings concisely as follows:

More work was accomplished when the subject competed with a former record, and with the results visible, than when the same task was performed without competition and with results screened. This is also true even if both work periods are added together and considered as a whole.

The extra exertion by the subject in competition series showed itself in diminished output in the second work period, even when this later period followed a four-minute rest. The extra work produced by incentive called for greater time for recovery.

This conclusion is important because some persons ingenuously assume that incentives increase output of work without additional energy expenditure on the part of the organism. When an industrial worker or a college student is working at the ebb tide of production, incentives can assuredly raise the level without injurious after-effects; but when a man is already expending much energy at his work, special incentives may inflict a penalty. Incentives are not magical devices for creating energy; they are rather a means of releasing energy, thus changing the activity level.

These findings, too, bear directly upon the contention of labor unions, previously referred to (p. 9), that added incentives, as in the "piece work" or the bonus system, may injure the health of the worker. For any given kind of work there is an optimum level of motivation, so far as permanent efficiency of production is concerned.

Effect of Praise and Reproof upon Intelligence-Test Scores. The existence of motivational factors in mental-test performance has been generally recognized. Terman, for example, stressed the importance of keeping a child encouraged during a test:

Nothing contributes more to a satisfactory *rapport* than praise of the child's efforts. Under no circumstances should the examiner permit himself to show displeasure at a response, however absurd it may be. In general, the poorer the response, the better satisfied one should appear to be with it. An error is always to be passed by without comment, unless it is painfully evident to the child himself, in which case the examiner will do well to make some excuse

for it; *e.g.*, "You are not quite old enough to answer questions like that one; but, never mind, you are doing beautifully," etc. Exclamations like "fine!" "splendid!" etc., should be used lavishly. Almost any innocent deception is permissible which keeps the child interested, confident, and at his best level of effort. The examination should begin with tests that are fairly easy, in order to give the child a little experience with success before the more difficult tests are reached.

Further, psychologists have expressed the opinion that teachers should not give mental tests to their own pupils, nor parents to their own children, because of a natural desire to show how brilliant the children are in whom they have a deep personal interest, and consequent inability to hold to the rigidly prescribed conditions of the tests.

The effect of praise and reproof upon test scores has been studied by Hurlock, using the National Group Intelligence Test. Two forms of the test were given to eighth and fifth grade children (average ages 13.9 and 11.6 years, respectively).

All the children of a grade were together at the first testing. On the basis of the intelligence quotient scores three equivalent groups were selected, and a second form of the same test was given one week later. A *control* group took the test as before under standardized test conditions. A *praised* group was strongly encouraged before taking the retest; they were told that they had been selected from the whole group because of excellent work the week before, and were urged to do even better and to set a class record. A *reproved* group was discouraged by telling them that they had failed in the test, that they were a disgrace to the class, and so on.

Results of the study show that both praise and reproof raised the average intelligence quotient scores seven points, whereas less than one point of increase resulted from practice alone in the control group. The differences between (*a*) the praised and the control groups, and (*b*) the reproved and the control groups, are statistically significant, while the retest gain of the control group is little more than a chance variation. A calculation of the percentage of children gaining, remaining the same, and losing, on the retest scores, gives us the following figures:

	Control	Praised	Reproved
% gaining	49.5	79.1	79.1
% same	10.9	3.3	6.6
% losing	39.6	17.6	14.3

The experiment leaves no doubt that praise and reproof influence the scores on intelligence tests.

Practically, these results argue for rigid adherence to standardized conditions in giving intelligence tests. Chance remarks of approval or disapproval from the examiner might readily change the child's test score.

Comparison of Motivating Conditions in Animal Learning. There is a vast amount of experimental evidence for the view that the rate of human and animal learning is profoundly affected by motivating conditions. A single illustration from the work upon maze learning of the white rat is presented here. Ligon worked with three kinds of incentives: (1) food in relief of hunger, *i.e.,* an incentive appealing to an inner physiological condition; (2) the presence of another rat, *i.e.,* a social incentive; (3) a constantly sounding electric buzzer in the goal-box, *i.e.,* an environmental non-social stimulation. All three kinds of incentives were effective in motivating learning, but they produced learning at markedly different rates of speed. Incidentally, the social motivation, with the white rat, was the least effective of the incentives used in the experiment.

These types of motivation were varied and combined in different ways. Three distinctive curves of learning have been selected from Ligon's graphs and plotted in Fig. 3. The upper curve was made by rats running the maze immediately after feeding, to an empty cage. The curve shows little learning and much variation from trial to trial, but it does show a small amount of learning. Escape from the maze was probably the goal which motivated this learning. The intermediate curve shows learning with social motivation. In the goal-box was another rat with whom the subject was allowed to remain for half an hour after running the maze successfully; the curve shown is an average of curves with varying degrees of hunger. The lowest curve obtained was made with an electric buzzer

in the goal-box combined with food reward; the runs were made six and twelve hours after feeding. All curves give the combined results for a group of rats. After examining these graphs no further argument is needed to demonstrate the importance of motivating factors in learning.

Change in Effectiveness of a Motive. As we have just seen, Ligon found that a constantly sounding electric buzzer in the

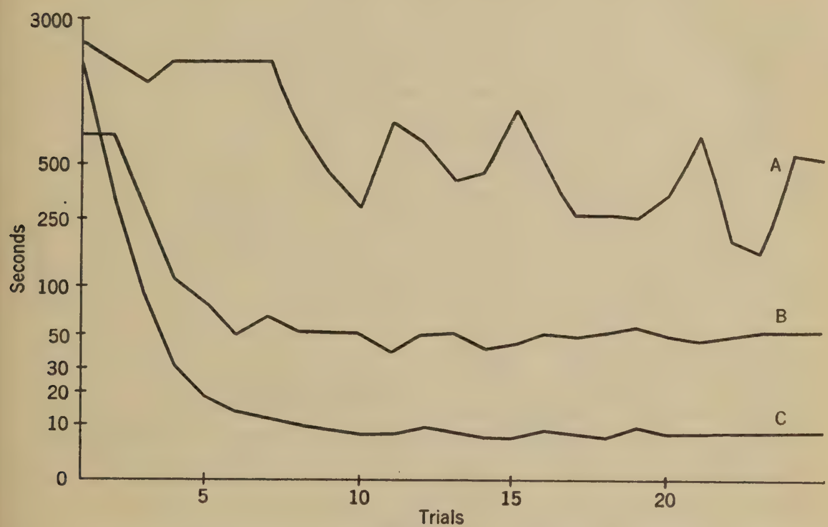


FIG. 3. A COMPARISON OF MAZE LEARNING OF RATS UNDER DIFFERENT MOTIVATING CONDITIONS. (*After Ligon.*)

Ordinates give time in seconds plotted logarithmically; abscissae give successive trials. (*A*) Learning curve for rats running after feeding to an empty cage. (*B*) Learning curve with social motivation, rats running to cage containing another rat. (*C*) Learning curve for hungry rats running to food and to a constantly sounding buzzer, both incentives in the goal-box.

goal-box of a maze motivated the rat so that learning was speeded up. Just why the rat learned better with this acoustic stimulation than without it is itself an interesting problem. Ligon explains the result by reference to "curiosity" or a possible "disagreeable" effect. Perhaps the analogy of a crowd gathering around the bass drum is worth mentioning in this connection. More specifically, it may be that the sound orients the rat towards the source and this orientation directs his progressive movements through the maze. Exploratory behavior or general activity would certainly bring the rat

ultimately to the goal if an auditory orientation towards it were more or less constantly maintained. But regardless of explanation, the fact is clear that a continuously sounding buzzer induced maze learning in the rat.

Figure 4 presents the curves of learning under three conditions. The solid line presents the graphs of learning with a food incentive. The dot-dash line is the learning curve with the electric buzzer

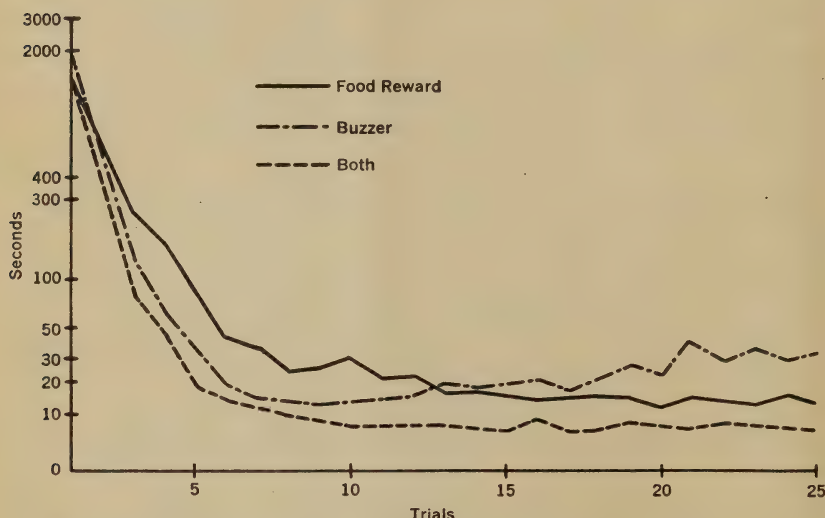


FIG. 4. MAZE LEARNING OF RATS WITH DIFFERENT INCENTIVES. (*After Ligon.*) Ordinates give time in seconds plotted logarithmically; abscissae give successive trials. The curves compare rates of learning under three motivating conditions.

sounding in an empty goal-box. The dash line is the curve obtained with food and buzzer motivation combined. This combination of incentives gives the quickest learning of all and the most constant performance after learning.

The point of especial interest in the present context is that with continued trials the maze performance with auditory motivation becomes increasingly poor. The curve of learning with the buzzer for incentive rises somewhat, indicating a gradual and steady loss in the effectiveness of this kind of motivation. Also the other two curves approach each other, which is to be expected on the assumption that the buzzer is losing effectiveness. In human psychology

this loss of effectiveness would be called "loss of interest" in the buzzer.

In general, the effectiveness of a given motivation varies with time. Some motives lose effectiveness quickly; others scarcely at all. Some are cyclic; they wax and wane, varying with bodily conditions. Others are persistent and vary in intensity with the inciting conditions of the environment.

The Quality of Highly Motivated Work. There is general agreement that moderately increased motivation raises the speed of activity and produces greater muscular strength; but statements in studies by Whittemore, Allport, Hurlock, and others indicate that the quality of work may be adversely affected at the same time (pp. 398, 404, 408). Psychologists are familiar with the well-known inverse relationship between speed and accuracy, especially in performances involving motor coordination and control. It is not surprising to learn, therefore, that an increase of speed, due to added motivation, may be accompanied by a decrease in the precision or accuracy of performance.

It is important to note, however, that a decrease in the accuracy or quality of the work is by no means the inevitable result of added motivation. Through instruction to the subject, with emphasis upon accuracy or qualitative excellence, the motivational increment can be made one of accuracy and quality, *i.e.*, a *qualitative* increment.

More than thirty years ago Mayer showed this to be the case by an experiment in which he used three sets of instructions. The first called for both speed and quality, the second stressed quality alone, and the third speed alone. The work was done in a public school of Würzburg, Germany. Fourteen boys in the fifth year served as subjects, and an equal number of boys as a control group.

The experiment was carried out under two main conditions, *viz.*: working alone, and working in a group. The three sets of instructions above mentioned were employed under both conditions. The experimental tasks were: copying from dictation, carrying out mental and written arithmetic, completion of sentences, and learning nonsense syllables.

From the corrected papers a score was worked out for each kind of exercise. These scores were found to vary both with the instruction and with the social situation under which the boys worked.

Among Mayer's conclusions was the observation that when both speed and quality were stressed, or quality alone, the work in a group situation resulted in fewer errors than did that in a solitary situation.

This finding is especially interesting in the light of Allport's conclusion that argumentative or discursive reasoning gives results of a better quality when the work is carried out alone than when it is done in a group. These opposite results obtained in the two studies on the effect of a group situation may be explained in part by the fact that the reasoning called for in Allport's experiment requires much more complex psychological processes than those involved in Mayer's simple tasks. A more important factor influencing the results is that of instruction; Mayer's subjects were specifically instructed to emphasize quality, whereas Allport's were not.

Apparently the attitude of the individual towards his task is a vital factor. If this is directed towards accuracy and quality of work, a bettering of these characteristics is likely to result. If accuracy and quality are not specifically emphasized, they may be lowered under conditions of motivational reinforcement which make for greater speed.

The present discussion calls for a brief consideration of the meaning of *quality*. Artists commonly claim that qualitative differences cannot be measured. For example, the difference between the performance of a Heifetz and that of an amateur cannot (it is said) be reduced to figures. Opposed to the artist's position is the scientific one which holds that whatever is discriminable can conceivably be described quantitatively. Lack of measurement is only a temporary failing in a developing science.

Without entering further into this friendly discussion between the artist and the man of science, we note that all human activities differ in two respects: *kind* and *degree*. A change of motivation may shift either the *kind* or the *degree* of behavior, or both.

THE EFFECT OF A COMBINATION OF MOTIVATING FACTORS UPON PERFORMANCE

When two or more incentives operate simultaneously the effect is generally more pronounced than when only one of them is present. After a careful review of the experimental literature, Diserens

and Vaughn stated the principle of summation in these words: "*The effectiveness of a given motive in any situation varies directly with the number of coöperating motives or facilitating factors, and inversely with the number of competing motives or inhibiting factors.*" The form of this statement should be modified somewhat, for it is not a given motive whose effectiveness varies, but rather the total configuration. Again, the principle is valid only within limits. If the degree of motivation be increased beyond a certain critical point, the result is typically a disruption of behavior.

In the three experiments described below, incentives were combined to produce motivational increments in performance.

Effect of Combined Incentives on the Performance of School Children. Chapman and Feder experimented with a group of thirty-six boys and girls in the fifth grade of a Cleveland school. The tasks employed were: simple addition (Thorndike's test); cancellation (Woodworth and Wells); substitution of symbols for numbers. At the start of the experiment the ability of the children in carrying out these tasks was determined and two equivalent groups were formed.

Chapman and Feder refer to these groups as *motivated* and *nonmotivated*. It is clear from their account of the experiment, however, that both groups were motivated by the same pattern of factors which underlies all serious school work; both had the same disciplinary background which regulated their activity; to both, the tasks were novel and interesting. The groups differed in their treatment in that the *motivated* group received additional incentives, as follows:

1. The results of the previous day's work for all subjects in the group were published; everyone knew them.

2. On the sheet presented to each child for a day's work, the score which indicated his achievement at the last period was marked in heavy blue pencil.

3. The curve of improvement for the group as a whole was presented graphically from day to day.

4. Credits in the form of stars were given regularly, (*a*) to those who were in the upper 50 per cent as regards the work accomplished on the previous day, and (*b*) to those who were in the upper 50 per cent as regards gross improvement. It was understood

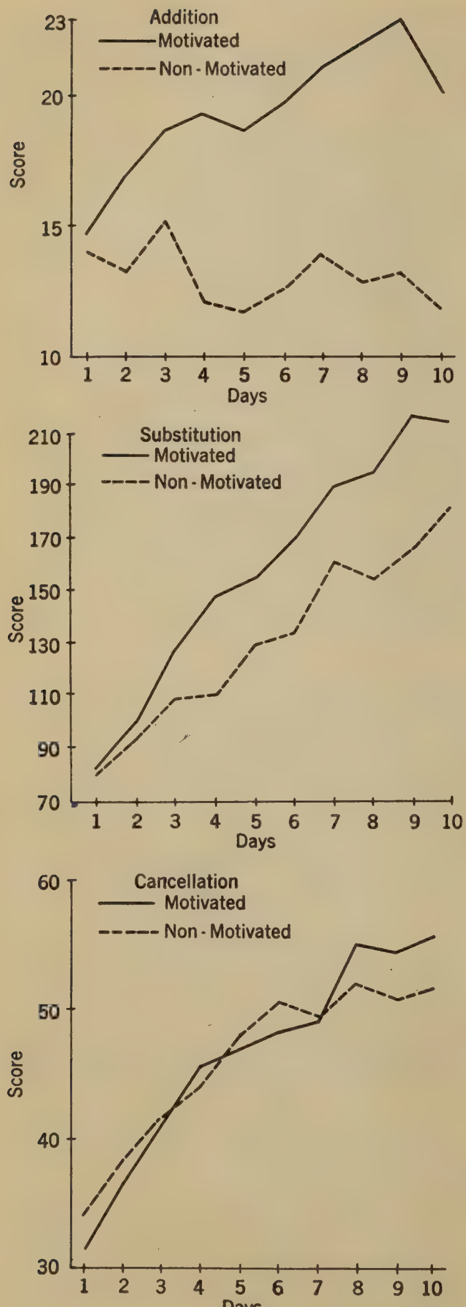


FIG. 5. EFFECT OF ADDITIONAL INCENTIVES UPON THE PERFORMANCE OF SCHOOL CHILDREN. (*After Chapman and Feder.*)

The curves show scores in tests of addition, substitution and cancellation made by groups of school children under different motivating conditions. The broken line in every case gives scores for the group with control motivation; the solid line those for the group with additional incentive.

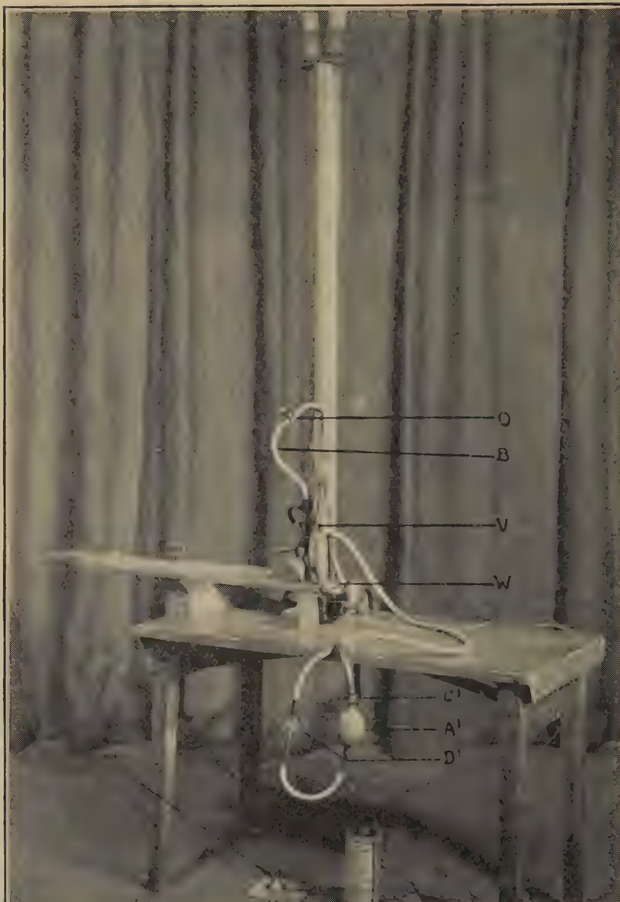
that prizes of nominal value would be awarded to the 50 per cent who at the end of ten practice periods had gained the greatest number of stars for efficiency and improvement.

This combination of additional incentives is complex, involving knowledge of results, reward in the form of prizes, social recognition for success, and much keener competition with one's own record and with classmates than occurs under normal class-room conditions.

Graphs which show the effect of practice upon the three tasks under the different motivations are reproduced in Fig. 5. These curves show clearly the effect of both motivations upon learning. The groups differ most markedly in the addition test, which is the one requiring the most time, *i.e.,* ten minutes. The curves of the substitution scores also show a considerable difference between the two motivational groups. This test required five minutes per day. The curves for the cancellation test show the two groups to be about equal at first, but during the last three days of the experiment the more highly motivated group has the advantage. This task took only one minute per day. It is probable that, with a longer work period and with the novelty of the cancellation task worn off, the more highly motivated group would show a still greater advantage over the control. All three curves indicate that the difference between the performance-levels of the two groups increases as practice continues, to the increasing advantage of the one having additional incentives.

Success and Failure Combined with Praise and Reproof, Reward and Punishment. Experiments upon human motivation, as we have seen, have contrasted the relative effectiveness of praise and reproof, reward and punishment, purpose and absence of purpose, knowledge of results and ignorance of results, success and failure, "will to learn," and the lack of a "will to learn," presence and absence of rivalry, working in a group and working alone, and so on. In a motivation experiment performed by Chase upon young children several of these motivations were employed in combination. Success and failure were controlled, and were combined with praise and reproof and with reward and punishment.

To control success and failure an ingenious motivation-dynamometer was contrived. The child was instructed to squeeze two bars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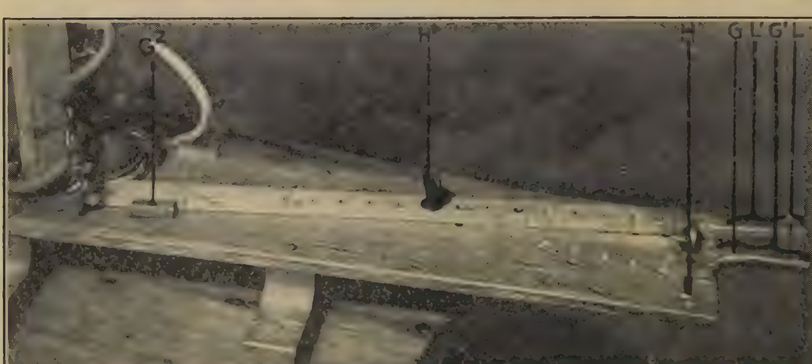
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together with maximum grip. The squeeze forced red liquid up a visible glass tube and a one-way valve held it at the maximum height attained during a series of several trials. When the liquid reached a certain level at the top of the tube a bell rang to indicate success. By readjusting the hydraulic system the experimenter contrived to control "success" and "failure" without the subject's knowledge. It took a little practice, of course, to manipulate the apparatus so as to eliminate the suspicion of trickery. The apparatus provided a means of measuring the child's actual strength of grip quite apart from his apparent "success" or "failure." Further details are given in the description of Plate I.

Another visible sign of "success" which proved to be of especial interest to the younger children was used in the final series. Instead of a column of water a fan-shaped board was placed vertically in front of the child. Pivoted to the board was a movable arm the outer extremity of which carried a toy cardboard train. On this board a railway track was painted and two small stations attached to it. When the child pressed the handles the train moved along the track toward the terminal station. "Success" in this case was indicated by movement of the train to the station. Actually the squeeze of the subject on the handles raised a column of water, exactly as in other series, and the maximum height of the liquid was secretly recorded as a measure of the strength of grip. But

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Plate I. Motivation-Dynamometer. (*After Chase.*)

The lower picture shows the lever system operated by the child's hand. A movable bar, pivoted at H' to a baseboard, presses against a rubber bulb filled with liquid, while a stop (G^2) limits outward movement of the bar. A stationary bar is adjustable along a slot (H), and can be clamped firmly at the point which best accommodates the child's hand. In taking a test the child grasps the rounded handles $L'L$ and $G'G$.

In the upper picture the lever system is shown at the left of the table. A vertical board supports two glass tubes, the front one visible to the child and the rear one visible only to the experimenter. When the child squeezes the handles together red water is forced up one of these glass tubes. A one-way valve maintains it stationary at the highest point. By adjusting appropriate stopcocks the hydraulic system can be arranged so that the height of the column of water in the rear tube, visible only to the experimenter, gives a true measure of the muscular strength of the child. At the same time an auxiliary bulb (A') makes it possible for the experimenter to control the water level in the tube which is clearly visible to the child. This auxiliary bulb, concealed from the child's view, is used to regulate "success" and "failure." If the subject "succeeds" in raising the column of water to a certain level at the top of the tube, an electric bell rings; if he "fails," the bell does not ring. This bell is controlled by a push button (M) operated by the experimenter's foot. (*Photographs reproduced through the courtesy of Professors G. D. Stoddard and C. A. Ruckmick.*)

through a trick, "success" and "failure" were artificially controlled without the child's knowledge.

There were 211 subjects ranging in age from two to eight years. The subjects worked individually, every child making seven squeezes per period. On the first day all children took the test under equivalent conditions. The experimenter was matter-of-fact, avoiding praise, reproof, and all but neutral comments; the task was presented as a test of grip in which a given pressure upon the bars produced a visible result. This initial testing gave a measure of grip under neutral conditions which served as a control for the later work. On the basis of the initial results four equivalent groups were formed.

These groups were differently motivated on the second and third experimental periods as indicated below:

Group	Experimental Series		
	I	II	III
A	Control motivation	Control motivation	Control motivation
B	Control motivation	Success repetition	Failure repetition
C	Control motivation	Success praise	Failure reproof
D	Control motivation	Success reward	Failure punishment

Conditions were arranged so that in the second test, one week after the first, groups B, C, and D would succeed; and in the third, another week later, the same groups would fail.

Praise and reproof were given by a series of standardized comments, a different one for each trial of a child. For example, "Splendid, ——! You certainly must be a big, strong —— to make the

bell ring." Or, "Why, ——, I thought that you were a big, strong ——, but I guess you're not. You didn't make the bell ring, did you?" Throughout the seven trials of an experimental period, the child met with consistent praise, or reproof, or reward, or punishment, or neutral conditions.

For reward a large gold star was placed after the child's name each time he made the bell ring. For punishment the general principle was to take away something the child had been given and wanted to possess. He was given the paper form of a boy with seven red buttons in a vertical row down one side of the jacket, and told that every time he made the bell ring the experimenter would add a button, but if he failed, a button would be cut off. After each failure the experimenter cut off a button.

Results indicate distinct differences among the groups. The "success" (II, B, C, D) and "failure" (III, B, C, D) groups are both superior in the average strength of grip to the control groups. This doubtless means that there is a motivational gain in having a visible goal even though the child consistently fails to reach it. The average score for the "failure" groups is higher than that of the "success" groups. It appears to the writer, however, that one cannot on the basis of this work make the general conclusion that failure is more highly motivating than success, for the following reasons. In the first place, the children in the "failure" group had all belonged to the previous "success" group, and their former success may in part have modified the initial mental set towards the task. Secondly, "success" and "failure" were not repeated long enough to guarantee the permanence and stability of the obtained difference. Again, the results are not strictly comparable, owing to the fact that the moving-train apparatus was substituted for the visible column of red water in the "failure" series; this introduced an element of novelty which would tend to enhance the "failure" motivation.

In the second experimental series the groups arranged themselves in the following rank order:

1. Success reward.
2. Success praise.
3. Success repetition.
4. Control motivation.

The difference in average scores between the first and second groups and between the second and third is not statistically significant; that between the first and third groups approaches significance; and all other differences are significant.

In the third series the groups arranged themselves as follows:

1. Failure reproof.
2. Failure punishment.
3. Failure repetition.
4. Control motivation.

The difference in average scores between the first and second groups is not statistically significant; that between the second and third and between the first and third groups approaches significance; all other differences are significant.

The above sequences indicate that success plus reward or success plus praise furnishes more effective motivation than success with mere repetition of the task. Similarly, failure plus reproof or failure plus punishment is more highly motivating than failure with repetition of the task alone. In other words, the additional incentives of reward, punishment, praise, reproof, yielded motivational increments over and above those referable to success and failure.

It is of interest to note that the younger children increased their scores in the second and third experimental series relatively more than did the older ones. This fact indicates that the experimental study of motivation can be carried on very profitably with young children. Naïve and uninhibited, they make excellent subjects for motivational experiments.

Throughout Chase's experiment an assistant kept a record of the kinds of behavior exhibited by the children. An analysis of the record sheets indicated that there was an output of energy through other channels than those controlling the dynamometer; muscles of the face, neck, and other bodily parts contracted during the squeezing of the instrument. This effect was especially pronounced in those series yielding motivational increments, and the higher the degree of motivation the more widespread was the muscular involvement. The children said they preferred the game with some motivation to that with control motivation.

Candy Reward Combined with Other Incentives. Everyone knows that offering candy as a reward is an adequate means of motivating children. Leuba made use of this fact in an experiment upon fifth-grade school children. In this study nineteen boys and sixteen girls were given ten-minute exercises in multiplication, three days a week for a period of seven weeks. At the start of the experiment the children were told that for a while there would be multiplication practice in an adjoining class room; the motivation for this preliminary and control work was presumably the same as that for other school exercises.

Beginning on the eighth day of the experiment, however, it was announced before each trial that a five-cent box of chocolate bars would be given to those who did a certain number of problems within the time allowed. The number of problems required to win the prize was marked upon the sheet of each child. This number was so chosen with respect to the ability of the child that on any given day approximately equal numbers of slow, medium, and fast multipliers would obtain a reward. For a few days the amount of work required to win a reward was gradually increased (increasing requirement). Then, after an interval with control motivation, the quantity of work was decreased (decreasing requirement).

Following this there were two days of control motivation; then rivalry was developed by the experimenter. On the last day a combination of many incentives was employed, including rivalry, praise, a definite goal, candy reward, in addition to the motivation normally furnished by the class-room situation.

In scoring the papers, speed rather than accuracy was used as an index of the extent to which the children had exerted themselves. The mean number of problems done in each of the ten-minute practice periods is shown in the following table of results.*

Examination of these figures reveals a marked augmentation of the number of problems solved on days when chocolate candy was offered as a reward. Leuba states that the candy reward brought an increase of 52 per cent above the control level. In the final complex situation with many incentives there was a gain of 62 per cent over the control level. It is important to note that when the reward was

* Leuba's table, from which these figures are taken, also presents the standard deviations and probable errors.

Day	Average Score	Motivation
1	19.9	Preliminary
2	22.3	,,
3	24.3	Control
4	23.4	,,
5	23.5	,,
6	23.2	,,
7	....	(Ambiguous)
8	27.7	Chocolate candy (increasing requirement)
9	31.4	,, ,, ,, ,,
10	32.2	,, ,, ,, ,,
11	32.4	,, ,, ,, ,,
12	23.9	Control
13	22.8	,,
14	....	(Ambiguous)
15	35.8	Chocolate candy (decreasing requirement)
16	35.1	,, ,, ,, ,,
17	34.4	,, ,, ,, ,,
18	23.1	Control
19	24.2	,,
20	34.6	Rivalry
21	38.9	Many incentives

removed on trials 12 and 13 and again on trials 18 and 19 the level of accomplishment fell immediately to that of the first control trials. This proves beyond doubt that the increments are truly motivational in origin.

The experiment also demonstrates that social incentives (rivalry, praise) can be added to biological (candy) with a greater release of energy than that produced by either kind of incentive alone. This result is to be expected in view of the fact that the distinction between social and biological motivating factors is an arbitrary one.

DEFINITION OF THE PROBLEM AND SCOPE OF MOTIVATIONAL PSYCHOLOGY

Having surveyed a fair sample of the concrete materials which demonstrate the presence of motivation, we are in an excellent position to consider critically the definition and scope of motivational psychology. The following sections are concerned with a formulation of the problem.

The Attitudinal Approach. It is literally true that an individual in good part creates his world. Mental organization and the set of an observer make things appear as they do. Assume for example, that the circles in Fig. 6 are arranged in groups of four

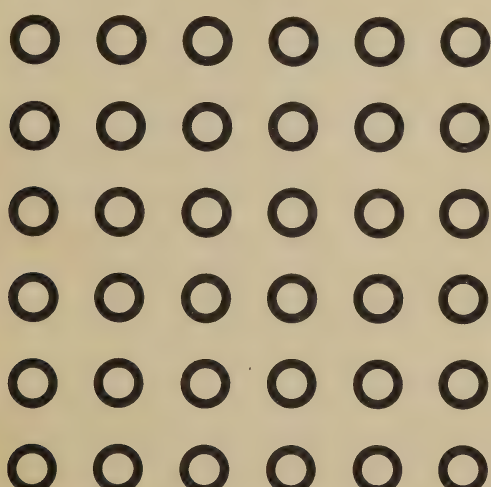

Fig. 6. A Figure to Demonstrate How Groupings Depend upon the Observer's Set.

with spaces between them, and look fixedly at the circles from the standpoint of this assumption; the circles appear to be grouped by fours. Now assume that they are grouped by nines; they *are* in groups of nine. Again assume a grouping by sixes first in a horizontal and then in a vertical arrangement; the various groupings appear. A wide variety of patterns can be observed merely by assuming them to exist and persistently looking at the figure with a particular set. Practice makes the observation more striking and more facile.

It is just the same in principle with the various facts of observa-

tion which constitute the ultimate data of the sciences. The datum, always observed by someone at a particular time and place, may be a point of light in a telescopic field, a discriminable difference in spatial position or in color quality, or a sense of solidity when an object is held in the hand. Regardless of its nature as sensory process, the assumption of the observer gives the observation its meaning and to some extent its apparent structure.

Scientific development is a continuous adjustment of attitude to the facts of observation. This leads in turn to the discovery of new facts and to new understandings in the field being investigated. Scientific development implies a constant interaction of observing and reflecting. The products of observation are the data of science, and the products of reflection are the attitudes of the men of science which are expressed by their logical constructions. Generalizations, hypotheses, theories—are built out of facts. These constructions in turn lead to critical experiments and new observations. The relationship between scientific logic and datum is circular, represented symbolically in Fig. 7.

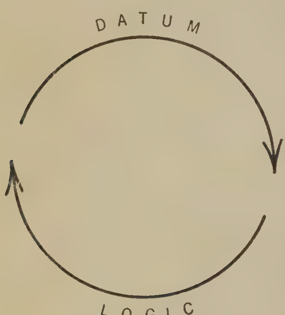

FIG. 7. REPRESENTATION OF THE RELATION BETWEEN SCIENTIFIC DATUM AND LOGICAL CONSTRUCTION

This emphasis upon the attitude of the individual is highly important in defining the scope of motivational psychology. We will designate it as the *attitudinal approach.* Its importance lies in the fact that an attitude regulates and directs the pattern of experience and behavior.

Physical and Mental Attitudes towards the Study of Motivation. It is a curious circumstance that the everyday question "Why?" calls for an explanation of physical movement in terms of conscious purpose or reason. A verbal statement of conscious purpose (which is mental) commonly passes as an adequate explanation of bodily movement (which is physical). This apparent contradiction vanishes when we realize that there are both physical and psychological approaches to the study of human conduct.

From the *physical* standpoint all behavior consists of changes in the tissues. Every muscle twitch, every nerve impulse, every glandu-

lar secretion, every chemical change in the body is determined by present and preceding conditions. A complete physical explanation of behavior would involve a description of the stimulus-response relationships included in the physiology of excitation; it would take into account the entire process of learning, the way adjustments are made, and the physiology of the thought processes. This complete explanation would tell the story of objective psychology, combined with parts of neurology, physics, and chemistry.

When, by contrast, behavior is viewed psychologically *from the standpoint of the conscious individual*, it is the meaning or significance of an activity which is of paramount importance. The "muscle-twitch" view of behavior vanishes, and the conscious experiences of an individual—plans, purposes, wishes, attitudes, interests, and the like—come to the foreground of the picture. The individual lives in a social world, seeking recognition and prestige. He is spurred onward by the praise and reproof of his companions, by prizes, threats, and punishments. He makes resolutions, consciously formulates purposes, cherishes grudges, retains phobias.

In explaining the persistence of motives, the psychologist assumes a relatively permanent and stable mind. A purpose may be said to persist in the mind until carried out in meaningful conduct.

There is no real incompatibility between physical and mental views of motivation. The real mechanism of behavior can be regarded either as a brain or a mind, as both, or neither, depending upon one's viewpoint. The writer assumes that there is only one kind of motivating structure within the organism and that this structure is fully adequate to explain all the pertinent facts of psychology.

We aim to formulate the principles of motivation so that they will be valid regardless of point of view. This is an ideal rather than an accomplished fact. When a contradiction between a physical and a mental formulation appears, that means that something still needs to be worked out. The assumption of a single motivating structure as the basis of all activity removes the difficulties latent in the dualistic opposition of a real mind and a real brain.

The Purposive Definition of Motivation. Some of the leading textbooks of applied psychology have classified incentives and motives together as a special class of conditions which facilitate

or inhibit behavior. One of these books tabulates four classes of facilitating or inhibiting factors. With slight modifications, this list follows:

1. *Physical environmental factors*—temperature, humidity, altitude, ventilation, illumination, distraction, and related conditions.

2. *General organic states*—fatigue, sleepiness, hunger, state of health, mood, comfort or discomfort, and the like.

3. *Specific conditions induced by chemicals*—such drugs as alcohol, tobacco, caffeine, morphine. To this group should be added the glandular hormones and other chemical agents produced by glands and bodily tissues which, when present in the blood, change the threshold of reaction to certain stimuli.

4. *Incentives and motives*—praise, reproof, rivalry, reward, punishment, knowledge of results, and so on; also various goals such as escape from confinement, prestige, a prize, money. In contrast to the first of the four groups of factors, these are derived mainly from the *social* environment.

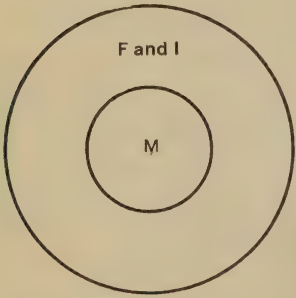

Fig. 8. Motivating Factors in Relation to Other Facilitating or Inhibiting Conditions.

This figure implies a limitation of the field of motivational psychology to a study of the spurs and checks of purposive behavior, and to such behavior itself.

From the standpoint of such a classification the term "motivation" designates one group of factors which facilitate or inhibit behavior. The relation of motivating factors to the entire group of facilitating or inhibiting conditions may be represented by two concentric circles, Fig. 8. The outer designates the total group of facilitating or inhibiting conditions; and the inner, the more limited range of those conditions which have been called "motivating." The distinction makes it imperative to discover the criterion by which motivating factors have been recognized as such and distinguished from the others.

A careful analysis of the above list will convince the reader that the distinguishing characteristic of group four lies in the *purposiveness* of the behavior which is presupposed. Concerning the definition of motivation in terms of purposive behavior, a few comments are necessary.

In the first place, it is clear that every goal-directed activity develops upon a stage in the background of which are many factors that support the action, that spur or check the goal-oriented behavior. Some of these are social, as the presence of a group of onlookers or a rival, praise or reproof. Others are physical and external as temperature, relative humidity, illumination, distraction, and so on. Organic factors such as fatigue, discomfort, hypothyroidism, a full stomach, etc., also facilitate or inhibit purposive behavior.

To define the problem of motivation as above, solely in terms of purposive activity, is too narrow. The animal develops purposive behavior out of random and aimless activity. Consider, for example, a rat deprived of food for twenty-four hours, and placed in the maze. He is active, moves hither and thither obviously in a random manner. If food is repeatedly found at the same place in the maze, the animal learns to run from the entrance-box to the spot where the food is located. This process of learning is one in which purposive behavior develops out of seemingly random or purposeless activity. Any limitation of the motivational problem to purposive behavior is necessarily cramping when purposeless activity has to be considered, and when one is especially concerned with the growth or development of purposes.

One further difficulty with the definition of motivational psychology solely in terms of purpose lies in the circumstance that one cannot always know what purpose is being shown by the animal's behavior. The difficulty may be illustrated by reference to an experiment of Wever upon the rate of swimming in relation to water temperature (pp. 61-63). Wever found that, when the water was cold, rats swam more quickly than when the water was approximately at body temperature. Does it follow from this result that the purpose of escaping from the water varies with the temperature? If so, at what temperature does the purpose to escape disappear? When the water is at body temperature the animals swim most slowly. Regardless of interpretation, results give in a continuous curve the relation between water temperature and rate of swimming. Fortunately this quantitative relationship between temperature and activity level does not depend upon the answer given to the above questions. The rat's comfort or discomfort, his desire to escape, his conscious purpose, are all experimentally unknown.

A broader formulation of the problem of motivation than that in terms of purpose is obviously needed. To this end the present book takes the stand that the central problem in the study of motivation is to account for the determination of behavior in all its aspects—to answer scientifically the question "Why?" The student of motivation seeks to understand and to explain how behavior is caused and how it is regulated.

The Question "Why?" Woodworth writes: "What you are doing in toto determines what you do piecemeal. If anyone asks you why you are doing this (detail), your answer is, 'Because I am doing that (total act).' 'Why are you turning the knob?' 'Because I am opening the door.' 'Why are you opening the door?' 'Because I'm going to the garage.' 'Why are you going to the garage?' 'Because I'm taking some people to the station.' 'And why do that?' 'I'm helping them get to their business on time.' Each smaller act finds its motive in the more inclusive activity in progress."

If this sort of questioning be carried to the limit, one arrives sooner or later at some basic motivation which is not to be questioned, such as the need for food, security, mate, comfort, bestowing parental care, prestige. If anyone should ask *why* you avoid a painful weapon, *why* you eat when hungry, *why* you desire the approval of others, *why* you fall asleep when tired, you would probably regard the questions as foolish. Life, you say, is made up of such things, and of course no explanation is needed. William James once wrote that only a philosopher or a fool would question the *why* of basic instinctive acts!

If Woodworth is right in his view that an activity in progress motivates subordinate ones, the implication is clear that certain basic activities go along on their own momentum, that they are self-motivating, and also furnish drive to the subordinate, partial activities. Woodworth puts it in this way: "A motive, we remember, is an activity in progress, and any complex activity, once the individual is fully embarked upon it, furnishes its own motivation."

Woodworth's view that one activity motivates another activity runs counter to common usage. We think of a motive not as an activity in progress, but rather as something which *determines* an activity. A purpose or a desire, we say, motivates the overt behavior which is in progress. It answers the question "Why?"

The Nature of Explanation in Scientific Psychology. From the dawn of human thought to the present, philosophers have sought some general principle or force which explains all human behavior. Recent examples are Bergson's *élan vital,* McDougall's *hormic force*, Freud's *libido*, Schopenhauer's *will*, Driesch's *entelechy*. All such postulations offer an answer to the question "Why?"

Primitive religious and animistic doctrines explain human behavior in terms of spirits. The behavior of mentally diseased individuals has been thus explained by assuming that an evil spirit took possession of the body; and cure was effected by casting out the devil. Traces of this doctrine can be found today.

Scientific explanation may be defined as a fairly complete description of some object, event, or relation, in which the facts to be explained are brought into relation with other facts, and in which functional relationships and correlations are discovered. In order that there may be no doubt as to the meaning of scientific explanation in psychology, three closely related kinds of explanation are noted below:

The first type is in terms of conditions, and may be called *conditional*. The behavior of an organism varies with objective conditions in its own tissues and in its environment. When one asks about the cause of a given segment of behavior the answer may be concerned with the factors in one or both of these spheres. For example, when I explain water-seeking behavior by reference to lack of water in the environment or in terms of persistent stimulation from the dehydrated mucosa of throat and mouth, I am explaining by reference to conditions.

A second type of explanation is *genetic*. It explains present behavior by reference to the past reactions or to the past experiences of an individual or species. It is the historical type of explanation, which points out how behavior develops. For example, when I explain that a thirsty animal has learned where water can be found and has gradually developed water-seeking habits, I am explaining genetically.

A third type of explanation is the *hypothetical*. In physics and chemistry the molecule, atom, electron, are all assumed to exist for the purpose of explaining observed phenomena. In psychology,

neural organization, mental set, associative bonds, are assumed in order to explain. If, for example, I assume the existence of a neural adjustment which determines water-seeking behavior, I am explaining by making an hypothesis.

These three types of explanation are all closely interrelated. The genetic type of explanation may be regarded as an extension into past time of the conditional account, so as to trace out temporal relations. Similarly, hypothetical explanation is an extension of the other types beyond the observed world into an assumed order of existence. An hypothesis is made and then tested. When we say that behavior is explained in terms of its conditions, we mean all conditions—present, past, imagined.

The Relation of Motivational to Explanatory Psychology. Inasmuch as motivational psychology is concerned with explanation, with answering the question "Why?"—it might seem advisable to identify the main problem of motivation with the general task of explanation. On this basis, motivational psychology is identical with explanatory psychology, or with the explanatory aspect of the total science. The explanation of all psychological processes, however, is an undertaking as broad as psychology itself.

Present-day psychologists have not envisaged the problem of motivation in any such comprehensive manner. Every fact of observation within psychology calls for explanation. In the field of perception, the numerous observations relating to visual depth, sound localization, illusion, and configuration demand an explanation. In the field of learning, the laws of conditioning call for adequate theoretical interpretation. In the study of dreams, hallucinations, after-images, and the thought processes, there is a constant need for elucidation in terms of determining mechanisms.

It is true that one and the same brain regulates both the perceptual configurations and the patterns of behavior. But despite this, psychologists have not yet seen fit to identify the study of motivation outright with the explanatory aspect of psychology as a whole.

If we take the experimental literature as our guide, we discover that motivational psychology has been primarily concerned with certain aspects of behavior (drive, purpose, liking and disliking, causation of learning, etc.) rather than with the interpretation of

conscious experiences. If we are to judge on the basis of contemporary literature, we are forced to the position that motivational psychology is a part, only a part, of explanatory psychology.

There is no logical reason for this limitation of the field. There is a practical justification for it in that explanatory psychology is much too broad in its scope for treatment in any single chapter or textbook. One is forced to select. At the present time no precise formulation of the field of motivational psychology has been generally accepted by psychologists.

There are two interrelated views, however, which make a strong appeal. One of these limits the scope of motivational psychology to the description and explanation of purposive behavior. The other, broader in outlook, defines the field in terms of biomechanics or the energetics of activity including the problem of the regulation of behavior. The writer has attempted to show the interrelation of these two formulations, and to demonstrate that both must necessarily be supplemented by a genetic account of the development of motives.

The Definition of Motivation in Terms of the Release of Energy. If we seek the most fundamental conditions of human conduct, we come ultimately face to face with the problem of energetics. In the strict sense of the term, a motive is that which arouses movement. Motivating conditions release energy and thus initiate bodily activity.

Accordingly, all the factors described in this book as motivating are conditions which release physical energy. The scientific study of motivation falls within mechanics, or more narrowly, within biomechanics. The bodily states of hunger or thirst, for example, are associated with energy release. If a rat is deprived of food or water, he becomes increasingly active up to a certain maximum of general activity. With longer deprivation periods the level of activity falls and the animal passes into a weakened and relatively inactive state. From the energetics viewpoint, the level of motivation increases up to a certain maximum and then decreases.

The release of bodily energy has definite relationships to the various endocrine secretions, as Richter, Hoskins, Cannon, and others have shown. Cannon has demonstrated that in times of great

stress the secretion of the adrenal glands mobilizes the bodily reserves of energy. This energizing effect is a motivating one.

Many forms of illness are followed by reduction of vigor. Persons who have suffered from severe attacks of influenza experience a prolonged period of weakness following the disease. The condition is characterized as a lack of energy or "pep"; and objectively it is apparent in a lowered activity level. In conditions of bodily depletion following overactivity and illness, relatively little overt activity occurs. The lowered level of energy expenditure, so far as that is shown in gross behavior, is a lowered degree of motivation.

The Regulation of Energy Expenditure. Once the field of motivation has been defined in terms of energy, questions concerning the regulation of energy expenditure arise. Some of these relate to the purposive set or goal orientation of an organism, which directs into definite channels the energy released by stimulation. Other questions refer to the passive structure of the organism, especially to the neural structure, which constantly limits and restricts behavior, just as the rails of a track limit the course taken by a locomotive.

The distinction between *limiting* and *exciting* conditions of behavior is an important one in any definition of motivational psychology. Some forms of behavior lack a dominant and persistent goal orientation. For example, a rat placed in an activity cage may turn the wheel vigorously for hours, seemingly without purpose. The familiar song "I don't know where I'm going, but I'm on my way" aptly describes the situation. Behavioral tendencies such as play, exploration, and general emotional excitement ordinarily lack a single fixed orientation; they often reveal the presence of many changing goals.

In the fundamental drives, however, the behavior of an animal definitely becomes directed towards a goal. In hunger, behavior becomes focused upon food or potential sources of food. In sexual behavior, the mate is the normal goal object.

In the case of the maternal drive, which Warden and his collaborators found under certain conditions to be the strongest of all drives in the rat, there is a fixed orientation of the mother towards the litter. If removed from the litter, she returns. Yet the maternal drive is not normally revealed by restless activity, *i.e.,* high energy expenditure in behavior; it is shown rather in the quiet nursing of the young.

Here is a strong determination in which "fixity of purpose" is the dominant factor. The case resembles that of Simon Stylites who showed a persistent determination with relatively little energy expenditure.

The regulation of energy expenditure is to a greater or less degree a matter of structural limitation in the sense that the structure of any machine restricts its performance. A man will not speak a foreign tongue, for example, no matter how greatly he is excited, unless the necessary neural structure has been acquired through a process of learning.

Motives and Incentives. Some of the essential motivating conditions are within the organism; others are within the environment. Thus, if an animal is hungry, the drive stimulus from his contracting stomach is obviously internal. The food object towards which the animal moves is clearly an environmental factor. To distinguish organic from environmental motivating factors, it has been suggested that the former be called *motives* and the latter *incentives*. Thus, desires, intentions, and goal sets are *motives*. Praise, reproof, reward, punishment, money, food, mate, etc., are *incentives*.

Incentives can be subdivided into two groups as *social* and *non-social*. The presence of another individual, his verbal suggestion, his emotional outcry, are *social* incentives. Purely physical stimulations, as cold temperature on the skin, a bright light on the eye, are *non-social* incentives. Any environmental stimulus may be regarded as an incentive when it is considered in relation to the arousal and regulation of behavior.

Final Definition of Motivational Psychology. Motivational psychology may be defined as the study of all conditions which arouse and regulate the behavior of organisms. The *arousal* of behavior necessarily implies a release of physical energy from the tissues. The *regulation* of behavior includes the control of activity through purposive determinations, as well as the restriction of activity by organic structure.

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CHAPTER II

THE ENERGETICS OF ACTIVITY

"The literal meaning of *motivation* is the process of inducing movement."

—Florence L. Goodenough

The phrase "spontaneous activity" occurs repeatedly in the literature of animal motivation. Strictly speaking, however, the conception implies indeterminism. On account of this, scientific writers ordinarily put the phrase "spontaneous activity" in quotation marks, explaining that all activity is causally determined but that much of it depends upon obscure physiological and environmental conditions. Viewed in this light, "spontaneous activity" is not "spontaneous" at all, in the strict sense of the word. With further knowledge it would be placed in the class of causally determined behavior.

A more useful conception within the field of behavior is that which differentiates the specific reaction patterns of an organism, on the one hand, from the general level of its activity, on the other. If the total activity of an organism be considered without regard to the specific patterns of behavior of which it is composed, one can truthfully say that at some times the animal is more active than at others. The concept of a general level of activity which varies with outer circumstances and with inner conditions is a thoroughly sound one.

SPECIFIC ACTIVITIES

The total activity of an organism can be regarded as a complex pattern built out of many separate segments of behavior. In the white rat, for example, it contains such segments of behavior as walking, running, climbing, sniffing, biting, gnawing, eating, drinking, urinating, defecating, preening, copulating, and fighting. These and many other bits of behavior can be recognized easily in the total stream of ongoing activity.

Some of these distinguishable activities appear rhythmically when an animal is observed under constant conditions; others appear sporadically. Eating, for example, is periodic; where there is an adequate supply of food the periodicity is approximately constant. Similarly, the drinking of water, the eliminative processes, female sexual behavior, sleeping, breathing (respiratory cycle), all have their characteristic periodicities. But no such cycles are known for gnawing, burrowing, climbing, preening, running, fighting.

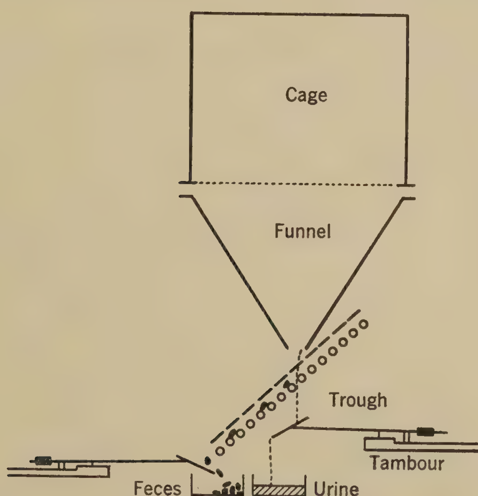

FIG. 9. APPARATUS USED IN RECORDING URINATION AND DEFECATION RHYTHMS. (*After Richter.*)

The tambours are connected to markers which write upon a rotating drum covered with smoked paper. A time line is also traced on the drum.

Cycles of Specific Activities and of General Activity. Richter has devised several ingenious forms of apparatus to register the successive times when a rat eats, drinks, urinates, defecates, etc. The apparatus diagrammed in Fig. 9 shows the means used for recording the urination and defecation rhythms. The behavior rhythms revealed by Richter's experiment are tabulated on p. 50.

For some activities, the periodicity and the associated bodily organs are definitely known. For others, such as nest-building, gnawing, and burrowing, the pattern of activity is obvious, but no periodicity has been discovered; nor is a bodily mechanism known which might cause such periodicity. For still others, a careful analysis of the

Activity	Periodicity	Principal Associated Organ
Urination	2–3 hour	Bladder
Drinking	2–3 hour	?
Defecation	3–5 hour	Rectum
Eating	3–4 hour	Stomach
Mating	4 day	Ovaries
Nest-building	?	?
Gnawing	?	?
Burrowing	?	?
Fighting	?	?
Migrating	?	?
?	7 day	?
?	18–22 day	?
?	40–120 day	?
?	?	Adrenal
?	?	Pituitary
?	?	Thyroid
?	?	Parathyroid

records reveals rhythms of general activity, but the physiological basis of these cycles and their biological significance remain unknown. In the last-mentioned class are activity waves with a seven-day period, an eighteen- to twenty-two-day period, and a long cycle with forty to one hundred and twenty days between the peaks of activity.

Richter pointed out that the periodic secretion of hormones from ductless glands might be the cause of these longer cycles of general activity. In more recent experiments, by surgical removal of various glands, he actually demonstrated the predicted relationship between internal secretions and the level of general activity. (The work will be described presently. See Figs. 17, 18, and 19.)

The Satiation of Specific Activities.* When a hungry rat is given an unlimited supply of food he at first eats rapidly and then gradually slows down as satiation approaches. As his period

* It may at first seem incorrect to employ the term "satiation" when referring to an activity rather than to an internal bodily need or a conscious appetite. It should be remembered, however, that the total process of satiation is the same whether one views it behaviorally, physiologically, or from the standpoint of individual experience.

of eating progresses he becomes increasingly distractable; extraneous behavior, such as preening, sniffing, and exploring, increases in frequency, and finally he deserts the food.

These changes in the rate of eating have been studied experimentally by Skinner, using two forms of apparatus.* With one form the rat was forced to reach down with his paw for specially prepared pellets of food. Every time the animal reached for one of these pellets a record was made automatically. With another set-up the rat had to learn to operate a lever which automatically released a stand-

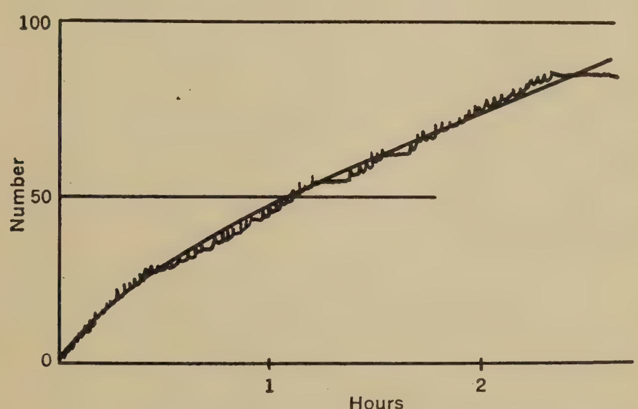

FIG. 10. CURVE SHOWING CHANGES IN THE RATE OF EATING. (*After Skinner.*)
Ordinates record number of pieces of food eaten; abscissae, time in hours from the beginning of the eating period.

ardized food-pill as in a slot machine. Each time the animal pressed the lever, the movement was recorded on a rotating drum.

With both kinds of apparatus results were the same. Figure 10 presents one of Skinner's curves. The equation for the curve of satiation was found to be

$$N = Kt^n$$

in which N is the amount of food which a rat has eaten up to any time t (counted from the beginning of the eating period); and K and n are constants. The value of n, Skinner found, was of approximately constant magnitude (0.67 to 0.71) throughout a series of experiments. If results from different experiments are plotted loga-

* They have also been investigated by the writer with similar results, but a description of the work has not yet been published.

rithmically, the curves become straight parallel lines, and n measures the slope of these lines. The constant K has been found to vary with the animal subject employed, the degree of hunger, the size of the pieces of food, and the unit chosen to plot the data. The value of K, therefore, has to be determined for a particular set of experimental results.

The fact that this equation is valid with both kinds of apparatus and for both types of behavior shows that the approach to satiation depends upon physiological changes which are wholly independent of the particular sensory-motor mechanisms by which food is obtained. As the rat approaches satiation the threshold values for the specific reactions of seizing, chewing, and swallowing the food are raised. This agrees with the observation upon human infants that the threshold for movements of sucking and chewing varies with the period of food deprivation. Skinner's work suggests, interestingly enough, that the demand for a given food can be measured in terms of the rate of eating.

In general, the idea of satiation as a limit which an appetite approaches as it is progressively satisfied is applicable to thirst, to sexual desire, and, indeed, to all normal cravings. The male sex drive of the rat, for example, is weakest after a period of copulation.

Lewin has applied the notion of satiation to various everyday activities, such as playing a piece repeatedly on the piano, manipulating a toy, and so on. In these activities one sooner or later has had enough and ceases. Lewin also writes of over satiation. In the case of eating, the surfeited animal may become not merely indifferent, but even negative to food. There is a distinction between *enough* and *too much.*

THE LEVEL OF GENERAL ACTIVITY

Although, as noted above, behavior can be analyzed into the segments which make it up, it can also be regarded and studied as an unanalyzed whole. If a guinea pig is placed in a triangular activity cage (Fig. 11), every bodily movement, without distinction as to its specific nature, can be recorded. A graphic record shows variations in the relative amount of general activity. Every movement of the animal in the cage, no matter how slight, leaves a mark; a

small, brief movement leaves a single short mark, whereas vigorous, prolonged movements leave a whole series of marks of varying amplitude. From the record the relative amounts of activity and rest per hour can be determined. These records, as we have said, do not analyze behavior into running, preening, scratching, etc. They merely show variations in the gross level of general unanalyzed activity.

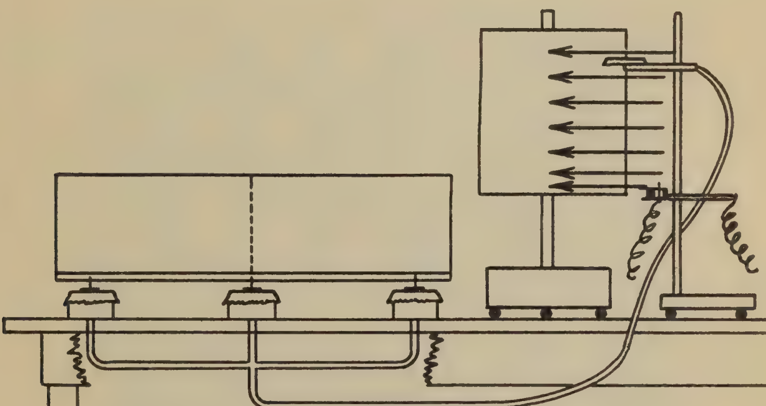

FIG. 11. RICHTER'S TRIANGULAR ACTIVITY CAGE. (*Drawing after Nicholls.*)

In this activity cage a triangular living compartment is supported at its corners upon tambours. The three tambours are connected so as to form a single pneumatic system. The tube from the series of tambours connects with a marker which leaves its tracing upon a rotating smoked drum. If an animal is motionless, the record on the drum is a straight line, but if the animal is vigorous and active, bodily movements are recorded on the drum as a series of marks.

Another type of apparatus used to study general activity is the rotating cage, shown in Plate II, which is similar to the apparatus commonly seen in zoological gardens for the exercise of squirrels, rats, and other small animals. These animals will sometimes run for hours almost continuously in the apparatus. When a rat climbs up one side of the wheel gravity pulls it in a counter direction. The more actively he runs the faster the wheel turns. An automatic counter, called a cyclometer, is attached to the axle to record the number of revolutions per hour or day.

The rotating drum records running activity; other types of behavior, *e.g.,* sitting quietly, preening, sniffing, etc., are not to any appreciable degree registered. Since running, in many animals, is a

satisfactory index of the level of general activity, the rotating cage is a useful apparatus for studying the conditions which regulate the activity level. A typical experiment with this apparatus is the following of Wang.

The Oestrous Rhythm in the White Rat. Wang kept female rats in rotating cages and recorded daily the amount of their running activity. He found a peak of high activity once in every four

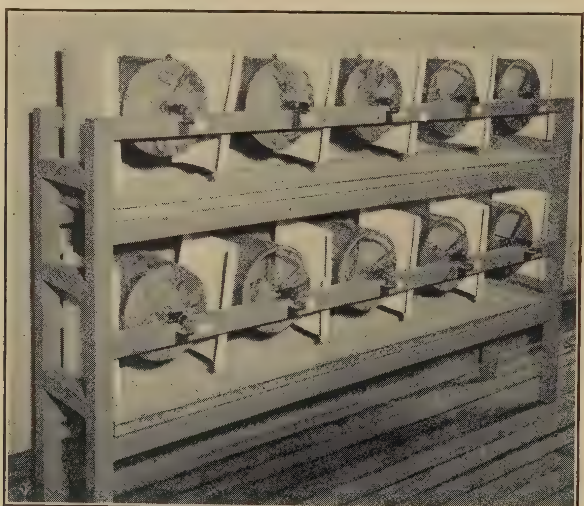

PLATE II. BATTERY OF ACTIVITY CAGES AT THE LABORATORY OF PSYCHOLOGY, UNIVERSITY OF ILLINOIS.

Some of the cages are opened to show where animals are introduced and removed. Counters are attached to the central axes of drums to record the number of revolutions in both clockwise and counterclockwise directions. Screens placed between the cages make it impossible for an animal to see others.

to five days. Figure 12 shows the alternations between relatively high and relatively low activity. The peaks of activity occurred at times when the female was sexually receptive to the advances of the male. These activity peaks and the sexual receptivity have both been shown to depend upon the secretions of the ovarian hormone.

That the secretion of the ovaries is the determining factor in this cycle rests upon the following experimental evidence: The activity cycles are absent in the male and in the prepubescent female. Wang found that before puberty activity in the female is at a low level and lacks a cycle; with the onset of puberty there is a sudden burst

of activity, with rhythmic fluctuations which at first are irregular in appearance and later become periodic. Again, the cycles are absent during pregnancy and lactation, when oestrus and ovulation are suspended. After a litter is weaned there is an uncertain period of ten or more days before the normal cycle is restored. Further, conditions which temporarily suspend the oestrous rhythm, such as infertile copulation or stimulation of the uterine cervix, also suspend

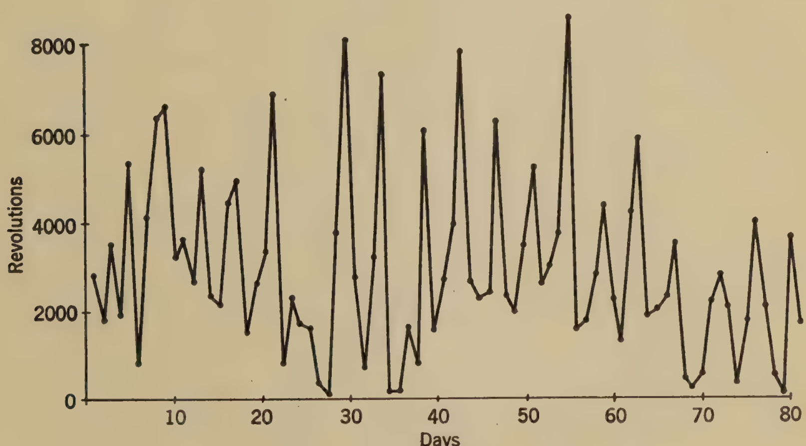

FIG. 12. TYPICAL ACTIVITY CURVE OF A FEMALE RAT. (*After Wang.*)
Ordinates give the number of rotations of the cage per day. Abscissae represent successive days in the course of the experiment. This curve was made by a female rat, aged 80 to 160 days.

the activity cycle. And finally, the activity cycle ceases with removal of the ovaries.

Here, then, supported by sound experimental evidence, is an example of the dependence of general activity upon a chemical agent in the blood.

Activity and Eating Time. If rats are fed regularly once a day, their general activity level varies in relation to the time of feeding. Richter studied this relationship, using the triangular activity cage shown in Fig. 11. The work was done in a vault under conditions which eliminated noise and odor. The temperature of the room was kept at 23°C., and the room was either dark or else at a constant illumination.

The distribution of general activity during the twenty-four hours

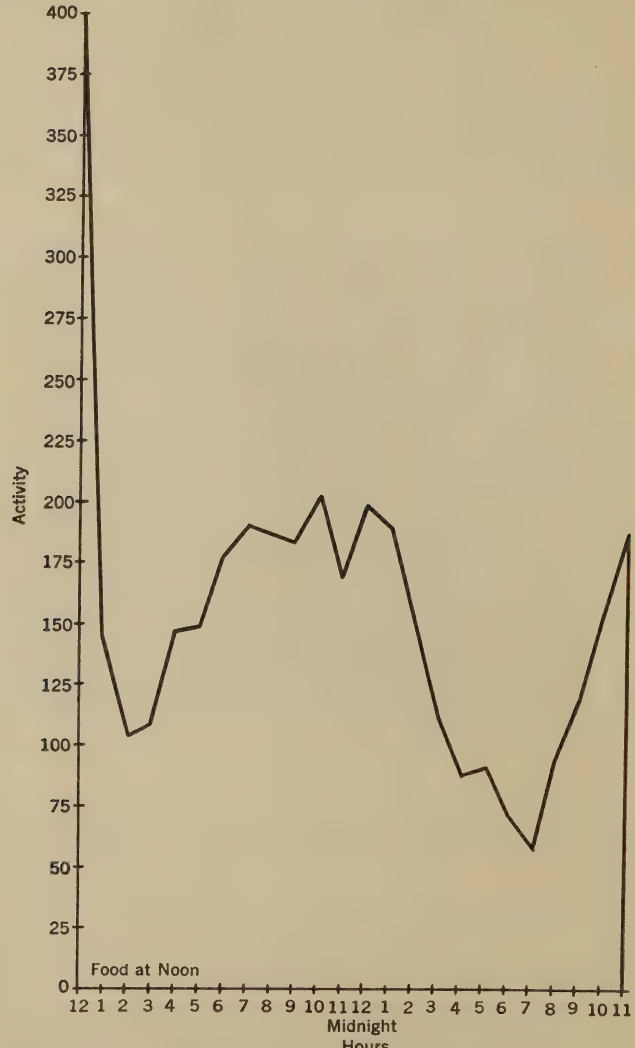

Fig. 13. Curve Showing the Distribution of General Activity During the Twenty-four Hour Period Following Noon Feeding. (*After Richter.*)

Ordinates indicate the amount of activity as determined by the number of marks on the kymograph paper made per hour by the rat. Abscissae give the successive hours following the noon feeding. Composite curve from 40 animals, 250 days old.

following the time of feeding is shown in Fig. 13. The curve shows the composite result from forty rats, 250 days old, fed at noon daily and tested individually. The ordinates indicate the number of marks made on the kymograph paper per hour, every movement of a rat in the cage making a mark. Abscissae represent successive hours in the twenty-four-hour period following each daily feeding. It should be explained that individual records show wide deviations in form from the composite curve here reproduced, also that the shape of the curve varies with the age of the animals.

When the feeding time was shifted from noon to midnight, and again when it was placed at 8 P.M., the shape of the activity curves remained the same relative to the time of feeding. This makes it evident that the time relative to the feeding-hour rather than the time of day is the important factor determining the shape of the curve. The curve was the same when records were taken in the dark and under constant illumination, which is conclusive evidence against changes in illumination having anything to do with the results.

The curve in Fig. 13 shows that, for four to five hours just after eating, the rats are inactive; after this they become intensely active again for eight to ten hours, then there is a period of five to seven hours of very low activity; during the last two to three hours general activity rapidly increases up to the time of feeding. In the last hour prior to feeding (11 to 12) there is a very marked rise of activity. The peak of activity in this curve shows that the activity level does not rise uniformly with the lengthening of the period of food deprivation. This fact is commonly recognized in human life. Immediately after a meal one is relatively inactive, but several hours later the activity level rises; and just before a regular and expected meal the activity level is higher still.

When rats are deprived of food continuously for a prolonged period of time, there is a definite increase in the activity level for two or three days, and thereafter a steady and marked decrease to the point of almost complete inactivity on the eighth day. When deprived of both food and water there is an immediate increase in activity on the first and into the second day, then a steady decrease to the point of almost complete inactivity on the fifth day.

Activity and Age. A young mother, a friend of the writer, attempted for one hour to imitate all of her one-year-old daughter's physical activities. Watching the baby, she sat down on the floor, pulled herself up by her hands, waved her arms about, crept rapidly this way and that, handled objects, vocalized, and so on. At the close of the hour she was thoroughly fatigued, whereas the baby was still in fine fettle. The baby, of course, had the advantage of smaller size; her activities involved relatively less physical work.

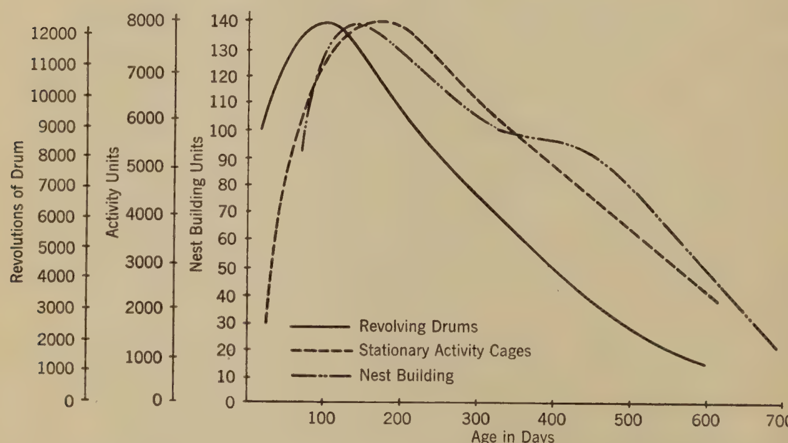

FIG. 14. RELATION OF ACTIVITY TO AGE ACCORDING TO THREE DIFFERENT METHODS. (*Modified presentation of Richter's curves.*)
The explanation is in the text.

It is commonly recognized that aged persons are not so active as children, and that older persons have less "pep" and vigor than the young. The writer has repeatedly observed a group of several hundred aged men and women (65 to 100 years old) housed in an old people's home, and he is impressed with the fact that they pass most of their time sitting around idly in their rooms and parlors, and relatively little in walking about the ample grounds and beautiful gardens of the institution. In an orphans' home the children can be seen running and playing actively out-of-doors from morning till night except in so far as special rules are enforced to keep them in their rooms; on the inside they are also in constant activity. These casual observations upon human behavior in relation to age agree with laboratory results from animal subjects.

The relation between activity and age in the rat has been investigated by Richter, using both the stationary activity cage and the rotating drum apparatus. In addition, nest-building activity was measured, in a neatly worked-out experiment, in terms of the number of strips of paper used in making the nest. This activity, too, was studied in relation to age.

Figure 14 shows the relation of activity to age as measured by these three methods. For the sake of comparison the scales are represented in proportions such that the maximal activity is at the same level for all scales. The curves agree in showing that the general activity of the rat increases with age up to a maximum at approximately 175 days, and then declines as age advances. Old rats are very decidedly less active than young ones.

It would be interesting to know whether the activity curve for the human life span has the same general shape as that presented in the above figure, but unfortunately this cannot be deduced from data obtained with white rats.

Activity and Illumination. Richter also compared the activity of rats in darkness with that under a constant bright illumination. The records indicate that the rat is more active in darkness than in the light; in other words, he is a nocturnal animal. The records show further that he becomes more nocturnal as age advances.

At the age of sixty days the rat is 1.34 times more active in darkness than in the light. From this age onward the ratio increases until at 600 days the animal is more than twice as active in the dark as he is in the light. What bodily basis there is for his increasing nocturnal activity is unknown. It may be an acquired adaptation, of obvious value in protection from enemies, rather than an hereditary trait. Whether nocturnal and diurnal tendencies change with age in man is not definitely known, but it is commonly said that man becomes more nocturnal in his habits with age.

Another investigation of the darkness versus light problem was made by Nicholls, who compared the activity of guinea pigs under uniform artificial light with that in complete darkness. Six pigs, weighing 200 to 300 grams (ages not specified), were given an activity test in darkness for a week, and again in light for the same length of time. The records were found to be similar under the two conditions; there was only one hour more of total activity

per day in darkness than in light, for the six pigs. To a very slight and doubtfully significant extent, therefore, the guinea pig is also a nocturnal animal.

Activity and Temperature. Between the temperatures of 75° and 80° F. guinea pigs can be seen stretched out quietly upon the floors of their cages, for at these temperatures they are relatively inactive.

Nicholls controlled the temperature of a dark room by means of an electric heater and took continuous activity records at different temperatures. The work was done in a special room of the Johns Hopkins physical laboratory, which was designed to maintain constant temperature and humidity, and to be free from vibrations. The temperature was varied from day to day, but was kept approximately constant throughout each entire day of the experiment. A thermograph was used to record any slight temperature changes.

Richter's triangular activity cage was employed. To obtain an objective measure, the number of feet and inches of kymograph record which showed activity was determined. Parts of the record with two and a half minutes or more of rest (one-eighth inch on the record) were not counted in the activity total. The hour during feeding and adjustment of the apparatus was omitted; and hence the daily record was for twenty-three hours.

Although the guinea pigs were active a large proportion of the time the amount of activity varied markedly with the temperature. It was demonstrated that as temperature rises degree of activity falls, and *vice versa.* Neither dangerously high nor extremely low temperatures, however, were used in this experiment.

The relationship between activity and temperature is presented graphically in Fig. 15. The graph shows an inverse relationship between activity level and temperature; at 65° F. the guinea pig is distinctly more active than at 85° F. At the lower temperatures the animals are almost continuously active, whereas at higher temperatures they take intermittent rest periods varying in duration from a fraction of a minute to about ten minutes. Some of the variability in activity shown in Fig. 15 is doubtless due to an adaptation factor. Although the room temperature was approximately constant for an experimental day, the sequence of changes from day to day was

somewhat haphazard, and this necessitated repeated thermal adaptation.

Another illustration of the relation between temperature and activity is taken from an experiment by Wever. In this work rats

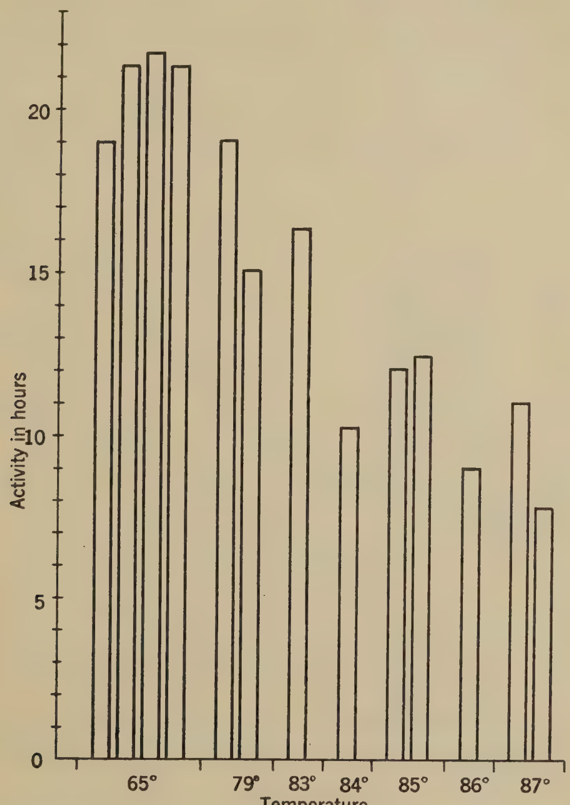

FIG. 15. RELATION BETWEEN TEMPERATURE AND ACTIVITY LEVEL IN THE GUINEA PIG. (*Data from Nicholls.*)

The height of a column indicates the average number of hours of activity occurring during a twenty-three-hour period, for three pigs. The base line shows the temperature.

were first accustomed to the task of swimming down a trough of water 220 centimeters long and 13 centimeters wide. The apparatus was tin-lined to prevent escape of the animals, and it was filled to a depth of 11 centimeters so as to force the rats to swim. The swimming time for this course was measured in seconds.

In the experiment eight temperatures of the water were used,

differing by 5° steps and held constant to within 1°C. Twenty-two rats swam the course twice a day for eight consecutive days. The second swim was always at a different temperature from the first, and the order of presenting the temperatures was irregular. The average swimming time for all the rats at each temperature was calculated, keeping the figures for the first and the second daily trials in two separate series.

Figure 16 presents these results graphically in two curves. The two curves, for the first and the second series of daily trials, are very

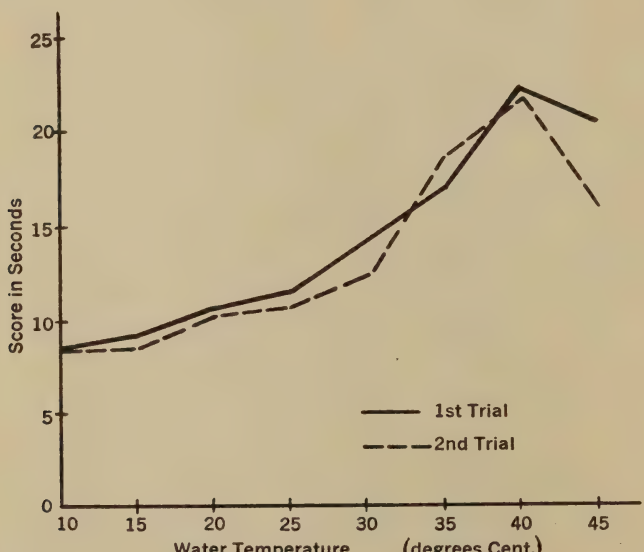

FIG. 16. RELATION OF WATER TEMPERATURE TO RATE OF SWIMMING IN RATS. (*After Wever.*) See text for description.

similar. The greatest activity and fastest swimming time occurred in cold water at 10°. The slowest time was at 40°, a temperature very close to the body temperature of the animals (about 37.5°). At 45° there was again an increase of speed but behavior became diffuse and disorganized. To the human hand 45° is hot, and a much higher temperature is distressing.

Wever states the result thus: "The rats' incentive to escape from immersion varies with water temperature, being greatest for low temperatures and least at values near body temperature; high temperatures produce considerable stimulation, but apparently of a dis-

orienting character, resulting in a relatively inadequate performance. . . ."

Despite the complete difference of conditions in the experiments of Nicholls and of Wever, their findings in general agree strikingly. From the two experiments the conclusion can be drawn that neuromuscular activity varies in amount inversely with the external temperature, for values below and up to body temperature. Wever's

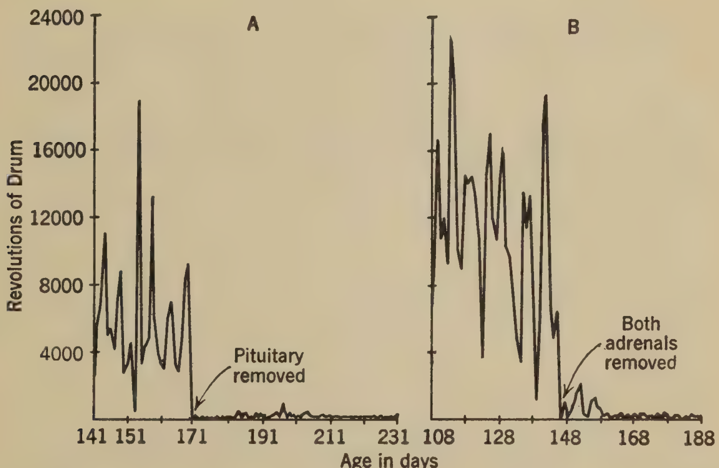

Fig. 17. (*A*) Graph Showing the Effect Produced upon Running Activity by Hypophysectomy. (*B*) Graph Showing the Effect Produced upon Running Activity by Adrenalectomy. (*From Richter.*)

experiment goes a step further, showing that, for temperatures moderately above that of the body, this relationship is reversed.

Activity and the Endocrine Glands. In recent experiments Richter has shown that the surgical removal of the hypophysis, adrenals, gonads, or thyroid is followed by a marked lowering of the activity level. After hypophysectomy the animals become almost totally inactive; the effect of adrenalectomy is less marked; that of gonadectomy still less; and that of thyroidectomy the least of the four, although it, too, produced a not inconsiderable reduction of activity.

Figure 17 shows the effect upon running activity of removal of the pituitary in one case and the adrenals in another. The subjects were female rats. After the operations the amount of general activity

suddenly and markedly dropped to a very low level, and remained at this level indefinitely.

The effect of gonadectomy upon running activity is presented in Fig. 18. The curves show clearly that the activity level is exceedingly low in the absence of the gonadal secretions. Despite the marked lowering of activity level, however, the relative variations dependent upon age are still appreciable (compare with Fig. 14).

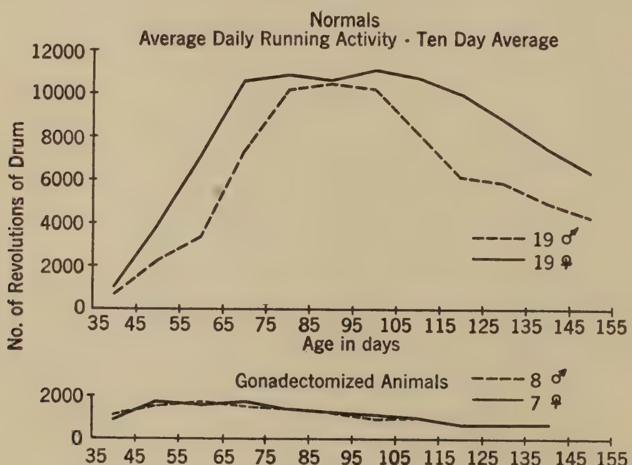

FIG. 18. *Top*—TEN-DAY AVERAGES OF RUNNING ACTIVITY OF NINETEEN NORMAL MALES AND NINETEEN NORMAL FEMALES. *Bottom*—TEN-DAY AVERAGES FOR EIGHT CASTRATED MALES AND SEVEN SPAYED FEMALES. (*From Richter.*)

One surprising result which sometimes occurred after surgical removal of these glands was the production or accentuation of activity rhythms. The graphs in Fig. 19 display them well. Precisely what bodily mechanisms are responsible for the appearance of these activity rhythms has yet to be discovered. The science of endocrinology is developing so rapidly that we can confidently expect much light upon the problems of activity and glandular function in the near future.*

It is important to note in this connection that a number of glands can be removed without affecting activity in any way. These include

* For an interesting survey of the activities of the endocrine glands the reader is referred to: R. G. Hoskins, *The Tides of Life, the Endocrine Glands in Bodily Adjustment.* New York: Norton, 1933.

the pineal gland, the thymus, and the posterior lobe of the pituitary body.

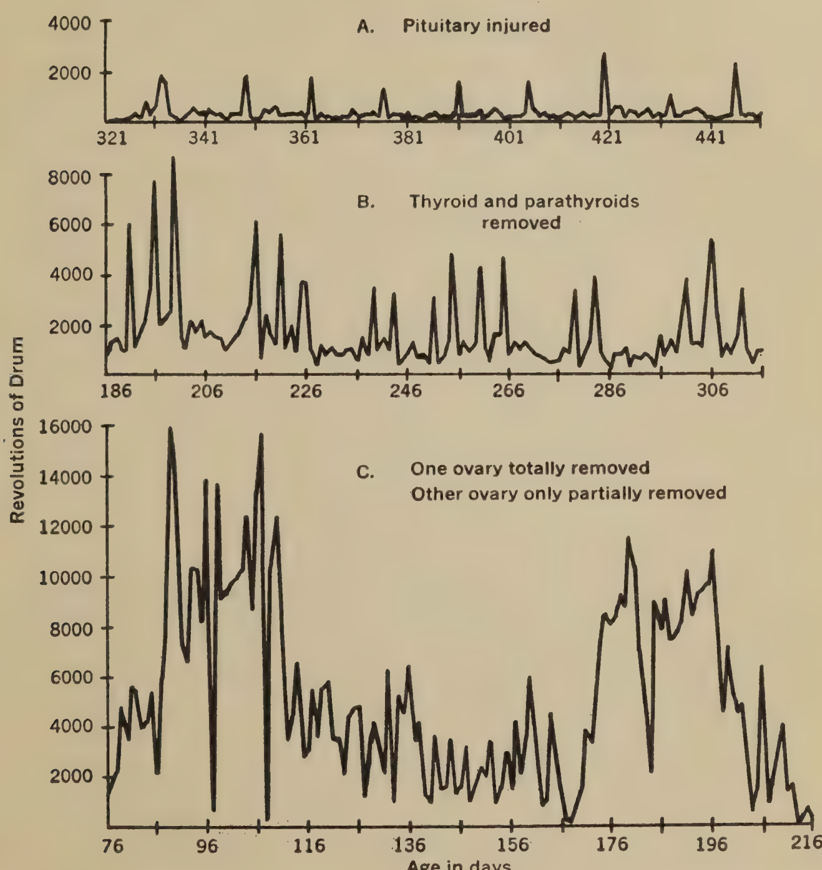

FIG. 19. (*A*) GRAPH SHOWING RHYTHM OF ACTIVITY IN A 12-16 DAY CYCLE PRODUCED BY PITUITARY INJURY. (*B*) GRAPH SHOWING RHYTHM OF ACTIVITY IN A 25-35 DAY CYCLE PRODUCED BY THYROIDECTOMY. (*C*) GRAPH SHOWING RHYTHM OF ACTIVITY IN A 90-100 DAY CYCLE PRODUCED BY TOTAL REMOVAL OF ONE OVARY, AND PARTIAL REMOVAL OF THE OTHER, LEAVING ONLY A VERY SMALL REMNANT. (*From Richter.*)

ENERGETICS

The Problem of Nervous and Mental Energy. There is no doubt that an individual often experiences an inner urge to action which he describes as a mental or a nervous tension, or pressure. The language of daily life is filled with expressions such as

"will power," "mental force," "strength of purpose," "emotional drive," which imply the existence of mental energies or forces.

In the laboratory the subjects themselves refer to "nervous energy," "inner urges," "mental impulses," and so forth. In an introspective study of the older type, Barrett wrote:

> Motive-force was often spoken of by our Subjects. They felt this or that motive strong or weak. They were conscious at times of a certain conflict between motives, as though two motives were measuring their strength. They were aware too, of the augmentation or diminution of the force of this or that motive, and at times, ventured to explain the cause of such phenomena; . . .

Professional psychologists differ in the emphasis they place upon will or conation (as it has been called). McDougall stresses "purposive striving" and "hormic force," which latter he regards as a vital impulse or urge to act. Bergson stresses the *"élan vital"*; Schopenhauer, the "will-to-live." Driesch and other vitalistic biologists have emphasized "entelechy" and similar dynamic principles which are opposed to the mechanistic interpretation of life.

Freud, Jung, and other psychoanalysts have hypothesized unconscious psychical energies as primary motivating agents. *Libido* is assumed to be a free mental energy which can be transferred and shifted from one type of activity to another much as a liquid can be shifted in a system of ditches; *libido* can be repressed, sublimated, redirected, etc.

These varied assumptions of vital forces have been in part based upon a realization of the remarkable complexities and adaptations of living organisms, plus an inability to explain life phenomena in terms of physics and chemistry, or conscious experience in terms of neurology. The assumption of mental force (which may or may not be identical with vital force) is grounded also in part upon one's consciousness of persistent activity in overcoming obstacles. Just as an individual is aware of himself as pushing, pulling, holding, resisting, and exerting muscular force in various other ways, so he is conscious of his own purposive strivings towards this or that ultimate goal, of his own endeavors to realize an ideal. An individual, in the course of life, experiences many thwartings and satisfactions, innumerable failures and successes, conflicting urges, and the like.

To account for these mental events the unsophisticated individual naïvely assumes the existence of mental forces.

In criticizing the postulate of mental force, one principle to note is that the psychologist has first the task of describing conscious experiences as they exist, and then of interpreting them. When an individual is dynamically active his experience is predominantly a motor one, often with affective or emotional coloring. Direct self-observation during activity reveals kinesthetic processes which are referred to the different muscle groups in action. The force, the struggle, the urge of purposive activity is described—so far as it can be observed—in terms of kinesthesis.

One can pass from careful psychological descriptions of the action consciousness to sound physiological hypotheses, or one can move towards the assumption of psychic forces. If one holds to the view that psychological hypothesis must harmonize with physiological fact, then doctrines of *libido* and similar psychic forces should be abandoned. In evaluating Freudism, Lashley recapitulates his total argument in the following words:

> To sum up, the psychoanalysts have developed a crude mechanistic system of explanation based upon analogy with simple physical forces and with complete disregard of physiological facts which bear directly upon their problems. Their explanations, in so far as they are based upon the conception of physical or vital energy, are flatly contradicted by physiological evidence. Psychoanalysis has done important work in emphasizing and systematizing problems and has given to psychology such valuable categories for classification of types of behavior as conflict, rationalization, and the like, but the dynamic principles which have been advanced to explain the action of the Freudian mental mechanisms are scientifically unsound. The problem of motivation is far more complex than the Freudians would have us believe and its solution is to be sought in the investigation of many related fields: the analysis of specific instinctive responses, the neural basis of emotions, the mutual influence of habits, the total integration of all such systems of reaction. The hasty postulation of such crude vital forces as the libido can only delay experimental investigation and postpone a real insight into the true nature of human motives.

An adequate picture of motivation must emphasize the basic

energy transformations going on within the organism; but these are physical energy transformations, not mental. The older notion of vital spirits moving through neural tubes vanished when a more exact neurology came on the scene. And so will the conceptions of vital and mental forces vanish with the continued development of physiological psychology.

The Physical Aspect of Behavior. Energy in the physical world appears in various forms as heat, light, motion, electrical potential, and so on—and one form can be converted into another without gain or loss. The law of the conservation of energy states that energy can be neither created nor destroyed, and that there is quantitative equivalence when it is changed from one form to another.

Energy, as a physical conception, can be considered as a product of two factors—intensity and capacity. In a waterfall, for example, the energy in the water at the bottom of the fall depends upon the height of the cliff (intensity factor) and the quantity of water in the stream (capacity factor). The physicist defines the energy of a moving body as $\frac{MV^2}{2}$. M is the capacity factor; $\frac{V^2}{2}$ is the intensity factor. Again, considering thermal energy, the intensity factor is measured by temperature, and the capacity factor is measured by mass $\times$ specific heat (thermal capacity). To illustrate, if one cubic centimeter of water is added to another cubic centimeter having exactly the same temperature, the thermal capacity is doubled but the intensity factor is unchanged. With electrical energy, the pressure is measured in volts (intensity factor) and the amount of current in amperes (capacity factor).

Helmholtz considered energy as "free" or "bound." The former may be utilized to do work, but the latter is not available. For example, imagine two similar copper balls isolated from their surroundings but in contact with each other—one of which has a distinctly higher temperature than the other. The total system contains a certain quantity of heat energy, describable in terms of temperature and thermal capacity of the copper balls. If undisturbed, part of the energy will pass from the warmer to the cooler body until finally both are equal in temperature. During this transfer the energy which is transferred may be used to do work, but once the transfer has

been effected a thermal equilibrium is established and no work can be got out of the system itself even though the system contains a large quantity of energy.

Within the animal body energy appears as movement—the movement of muscles, blood, lymph, and various other organic movements—and as body heat. The source of this energy is the oxidation of substances stored in the body. Thus, within the body, energy is chemically "bound," and it is the release of this potential energy which makes it possible to do muscular work. The liver, for example, stores potential energy, to be drawn upon continuously to meet the body's needs, in the form of glycogen. In biological emergencies these bodily reserves of energy are drawn upon more extensively than under normal resting conditions, and vigorous, prolonged activity ensues.

Viewed physically, motivation is the process by which movement is produced and regulated. The basic questions in a study of motivation are concerned with the release of potential energy, and with the direction and regulation of energy expenditures so as to produce purposive activity.

The standpoint of energetics is familiar to the physiologist. In studying metabolism, for example, the amount of oxygen converted into carbon dioxide, per unit of time, is commonly used as an index of the rate of certain chemical reactions going on within the tissues. Again, in the experiments upon muscular work and fatigue the point of view of energetics is regularly assumed.

Every stimulus which excites a response in a receptor cell releases energy within that cell. Similarly, receptor cells release energy in the neurons; the neurons in turn release energy stored in other neurons (for the propagation of a nerve impulse involves expenditure of at least a small amount of energy); and finally, energy is released in the gland and muscle cells. When an individual muscle fiber contracts, doing work, it utilizes energy stored within itself, but oxygen, sugar, and other substances are taken constantly from the blood. The entire physical process of behavior, from the simplest response of a cell to the most prolonged and vigorous activity of an organism, is one of energy transformation within the body.

What *does* motivate us? Is it the energy stored in the tissues? Or

the stimuli and other conditions which release the energy? Or the kinetic energy itself after it has been released?

The answer to these fundamental questions is much the same as in the classical example of the billiard ball. What motivates it in its course across the table? Is it the mechanical energy transferred through the cue from the muscles of the player? Or is it the kinetic energy in the moving ball, which is gradually reduced by friction? The question, "What makes the billiard ball move?" raises one of those ultimate problems which seem to extend beyond the realm of science. The best one can do is to describe the motion carefully and to study all the conditions upon which its characteristic motion depends.

Similarly, the question, "What motivates a man?" is an ultimate one to the physicist. In considering this question from the physical point of view the following points are important: First, the immediate energy source of behavior and of all muscular work is certain chemical substances stored in the body. Second, stimuli, both environmental and internal, release this energy which is stored within. And third, in the energy transformations, heat and work are produced. Finally, energy expenditure is regulated and directed so as to produce certain results in behavior.

The last of these points will be taken up later in our study. We must find out, for example, why Mary slammed the door yesterday and why she closed it quietly today. This is a problem in regulation and control of energy expenditure.

Critique of the Doctrine of Drive. The term "drive," which has been widely used in discussions of motivation, came into psychology quite recently. The word, in its modern sense, was first used by Woodworth in 1918, in his *Dynamic Psychology*, and from this source it was taken up by animal psychologists. Woodworth wrote:

> Once the point of view of a dynamic psychology is gained, two general problems come into sight, which may be named the problem of "mechanism" and the problem of "drive." One is the problem, how we do a thing, and the other is the problem of what induces us to do it. Take the case of the pitcher in a baseball game. The problem of mechanism is the problem how he aims, gauges distance and amount of curve, and coordinates his movements to produce the desired end. The problem of drive includes such questions

as to why he is engaged in the exercise at all, why he pitches better on one day than on another, why he rouses himself more against one than against another batter, and many similar questions. . . .

Woodworth spoke of *drive*, not *drives*; using the word in a general, not a specific, sense. He derived the term from mechanics; a machine must be driven if it is to move, and the drive of a machine is the supply of energy that puts the mechanism in motion.

In a personal communication, from which I am permitted to quote, Woodworth writes as follows:

I believe you are right in supposing that the current use of "drive" in animal psychology and other psychology springs from my use of the word in "Dynamic Psychology," 1918. I am sure I did not derive the word from any previous psychologist. I got it from mechanics. A machine has a mechanism, such that if it is put in motion it operates in a certain way; but it must be driven in order to move. The "drive" of a machine is the supply of energy that puts it in motion.

I went on to argue that the drive of behavior might be hunger or any instinctive tendency, but could also be any activity already aroused.

The animal psychologists took up the word, as it seemed to me, because it carried no implications of conscious motive. As far as I know, the first to use the term in animal psychology was F. A. Moss who published a paper in 1924 on the "Study of Animal Drives," in which he introduced his "resistance" apparatus for measuring the drive in terms of the amount of resistance (electric shock) which it would overcome. This usage was soon followed by Dashiell, 1925; by Tolman, 1926; by Richter, 1927; by Warden, 1928. Moss writes me that he was familiar with my "Dynamic Psychology," though he does not definitely recall adopting the word from me. He used the term, "not to describe any instinct or necessarily inborn condition in the animal, but to describe a certain set of chemical conditions that make the animal move in a definite direction in the same way that the explosion of gas in the chamber of the automobile makes the piston move up and down. Dashiell, also, in his textbook of 1928, starts his account of drives by a reference to my book. So it seems likely that the animal psychologists adopted the term from me.

It is true that the Germans use the word "Trieb" both for the drive of a machine and for animal impulse. German psychology has long

spoken of the "tierische Triebe," such as the "Nahrungstrieb" and the "Tätigkeitstrieb." The word here carries the idea of blind impulse. "Drive" as used by the Americans seems not to carry this implication. The hunger drive is no less a drive when it leads to a deliberate search for food. Although the usages are so similar, they have no doubt arisen independently.

There is another slightly different use of the word, illustrated by the sentence, "He has ability but lacks drive." I believe this usage has arisen from that of the animal psychologists. It is a shade different from the long-standing usage referring to the drive of business or of a factory manager, and is more like another German usage, in which "Trieb" means about the same as "inclination."

When Moss used the term "drive" in 1924 he wrote of specific concrete drives such as hunger, thirst, and sex. The basic thesis of his study is that *"The behavior of any animal is the resultant of his drives to action and the opposing resistances."* Drives are "impelling forces" in the situation that stimulate the animal to positive behavior, *e.g.,* the hunger drive impels to food-seeking; the maternal drive impels the mother to go to the young, especially when they show distress. Resistances are "repelling forces" that stimulate to negative behavior; *e.g.,* the presence of cats repels rats; and again, if rats are placed in a maze the floor of which is covered with crushed ice, they avoid the cold and seek the relatively warm, dry goal-box.

After a series of experiments Moss drew some conclusions which stress the dynamic relationships of "drives" and "resistances." The main theses are reproduced below:

1. Any animal drive may be measured in terms of the resistance overcome, provided the strength of the resistance is known. Or, where the strength of the drive is known and that of the resistance is not, the resistance may be measured in terms of the drives.

2. Any drive that succeeds is stronger than the resistance overcome, and any drive that fails is not as strong as the resistance. For example, if a hunger drive caused by a forty-eight-hour starvation period, will make the animal take an electric shock of 12 v. to get food, but fails to get him to take the shock of 20 v., we may say that the strength of a forty-hour hunger drive lies between a 12 v. and a 20 v. opposing stimulus, being stronger than the 12 v. but weaker than the 20 v.

3. If two independent drives are opposed by the same resistance

and one drive overcomes the resistance while the other fails, the one that overcomes the resistance is the stronger drive. For example, if a seventy-two-hour hunger drive overcomes a 20 v. resistance and a sex drive fails to overcome the same resistance we may conclude that the hunger drive is stronger than the sex drive.

4. Given two drives both functioning at the same time, and so arranged that neither can succeed without neglecting the other, the one that succeeds is the stronger drive. This is well illustrated in the balancing of hunger drive against the sex drive.

5. Given two antagonistic resistances both functioning at the same time and both so arranged that neither can cease to function without overcoming the other, the one that overcomes is the stronger resistance. This is illustrated where the two opposing stimuli are the ice and the electric shock.

6. When one drive by itself is not strong enough to overcome a resistance, it may be reënforced by other drives, until it is strong enough to overcome the resistance.

7. As a motive force is provoking the learning of such problems as the maze, that drive is strongest which causes the animal to learn the problem in the shortest time and with the fewest errors.

8. Other things being equal, every time a resistance is overcome, the strength of that resistance is weakened.

Following Woodworth and Moss, the term "drive" was employed by Dashiell, Tolman, Richter, Warden, Stone, and others, until today this word is in common use in animal psychology, and frequently appears in the elementary textbooks.

Warden has defined his conception of drive in a purely descriptive way as a behavioral tendency directed towards or away from some specific goal object, such as food, water, mate, etc. He writes: "By a *drive* we mean an aroused reaction tendency which is characterized primarily by the fact that the activity of the organism is directed towards or away from some *specific incentive*, such as food, water, animal of opposite sex, etc." And again: "The term *drive* does not refer to the physiological state or system aroused either by an incentive or by deprivation of some sort, but to the behavior tendency resulting from the internal arousal."

Holt in discussing animal drive, points out that it has two basic meanings: (1) Drive is the *energy* which does work—chemical energy contained in food and stored in the sense organs, nerves,

muscles, and other tissues. (2) Drive refers to those *agencies which release stored energy*—stimuli impinging on sense organs without and within.

The above meanings of the term "drive" are so divergent that confused thinking will inevitably result unless the concept be defined precisely. The difficulty is further increased by overlapping meanings of "drive" and "incentive."

In everyday life "incentive" means: "Something that arouses feeling, or incites to action; an exciting cause or motive; an incitement, provocation, 'spur.'" The word is apparently confounded with incensive, and other derivatives of the Latin *incendere*, to kindle, set on fire.*

Warden has limited the term "incentive" to mean an external goal object—food, water, mate, etc.—which is capable of operating to arouse some fairly definite seeking tendency or drive. Inasmuch as internal and external factors usually cooperate in producing and regulating bodily movement, the compound term "incentive-drive" is sometimes used to designate the whole complex of energy-releasing conditions.

Incentives, according to Leuba, have both an inner and an outer aspect: "There are two aspects to an incentive: the incentive situation and the incentive attitude stimulated by that situation. The various incentives are names for the various situations which will arouse the incentive attitude." It seems doubtful, however, whether the same word could be employed without confusion to designate both the exciting situation and the inner determination.

Some of the current psychological interpretations of "incentive" are:

1. The goal object which satisfies the man's or animal's seeking, *e.g.,* food when hungry.

2. The painful stimulation which evokes negative behavior, raising the activity level, such as the whip, spur, or electric grill.

3. In human psychology, "incentive" may refer either to a goal object, or to a variety of special factors which facilitate or inhibit performance, or which affect the attitude of a subject, *e.g.,* praise and reproof, reward and punishment, knowledge of results of work done.

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* Murray's *New English Dictionary.*

4. Occasionally the term is employed to designate background factors which facilitate or inhibit behavior, as temperature, humidity, illumination, noise, music. These background factors raise or lower the level of activity regardless of whether the behavior in progress is goal-directed or not.

5. Finally, the term "incentive" is used loosely as a synonym for "motive."

If we return now to the consideration of the term "drive," we find within psychology at least six distinct meanings:

1. Drive is the energy which moves the body.

2. Drive is the stimulus or else the internal tissue condition which releases energy and leads to activity.

3. Drive is general activity. For example, in the activity cage the female rat shows rhythmical variations in "drive."

4. Drive is any behavioral tendency, whether goal-directed or not, such as playfulness, sociability, laziness, exploratory trend, restlessness, etc.

5. A drive is a specific, goal-directed activity such as food-seeking or mate-seeking.

6. Finally, in human psychology, drive is a motivating factor within the personality—an interest, purpose, or wish. In this sense, a specific drive is a relatively stable set of the organism which more or less persistently directs behavior along a fixed course. For example, Simon Stylites possessed drive, even though he expended little energy in physical work.

In view of the diversity of current meanings of "incentive" and "drive," the time appears to be ripe for a sharper analysis and clearer definition of terms. The present confusion has been brought about indirectly by the attacks made by Kuo and others upon the traditional doctrine of instinct. Much of what was formerly the meaning of "instinct" has been inadvertently transferred to the conception of "drive." Psychologists today speak of instincts with lifted eyebrows, but drives, whether we understand their nature or not, are still in excellent repute.

The Energetic Conception of Drive. In Woodworth's original sense, *drive* is the physical energy which makes the machine go. This energy is stored within the tissues and released by a variety of stimulations from within the organism and from its environ-

ment. Energy released or expended is manifest outwardly in behavior. Every muscle twitch, when physically viewed, is an energy transformation. Every bodily activity, from the simplest reflex to the most prolonged and complex purposive act, is, from the standpoint of energetics, a physical process.

This view of drive is useful to the psychologist. Other things being equal, the greater the amount of work accomplished the greater is

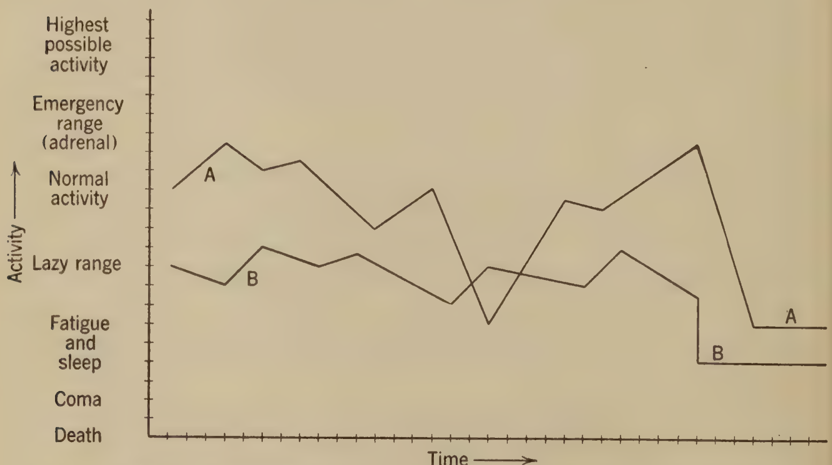

FIG. 20. SCHEMATIC REPRESENTATION OF FLUCTUATIONS IN GENERAL ACTIVITY LEVEL. The vertical at the left represents the hypothetical scale of activity from maximum to zero (reached only at death). The horizontal represents arbitrary units of time. The irregular lines *A* and *B* portray variations of general activity for two individuals.

the energy expenditure, or drive. If a 180-pound man climbs from the bottom of the Grand Canyon to its rim, carrying 20 pounds of clothing and pack, more than 1,000,000 foot-pounds of work have been accomplished. If the same man relaxes and sleeps at the top of the canyon, there is a marked drop in the expenditure of energy toward the bare minimum necessary for continued existence. The climbing man reveals much drive; the sleeping man, little.

The above contrast is an extreme one, but one meets similar, though less pronounced, contrasts in activity level constantly in everyday life. We all have our ups and downs in the rate at which we expend energy. Consider the sketch in Fig. 20.

There are many conditions which determine the activity level at any given time (pp. 52-65). Persistent stimulation from the tis-

sues in hunger, thirst, pain, cold, etc., may act singly or in combination to regulate the rate of energy expenditure. Tissue conditions dependent upon age are factors. Receipt of good news, success in love, praise, and other pleasant experiences are all associated with a raise of the activity level. Disease may markedly lower the level of activity. After a severe attack of influenza, for example, the patient generally experiences a prolonged period of enervation. These are only a few of the various conditions which play a part in the regulation of activity level.

Some individuals are characterized as being uniformly energetic, vigorous, forceful, powerful in whatever they do; others are described as lazy, listless, lacking in energy and force. The former accomplish much physical work; the latter achieve little. (Compare *A* and *B*, Fig. 20.) The difference is appropriately called one of *drive*, because the energetic, active individual actually does expend more energy than the lazy one.

The same kind of a difference exists in rats. In a doctoral dissertation at the University of Illinois, E. E. Anderson gave a group of fifty male rats a number of tests, most of which were motivational in character. Significant positive correlations among the test scores were found. Factor analysis of these correlation coefficients was carried out by Thurstone's simplified method, and several factors were revealed. The first of these is a general one which can reasonably be interpreted as *drive*. If this interpretation be correct, it can be said that individual rats differ characteristically in their general vigor or drive in the same way that persons are commonly observed to differ.

Another conclusion of Anderson's investigation is that the intercorrelations which he obtained are not accounted for adequately by reference to the traditional drives. He suggests that certain basic and independently variable factors may exist, which are more fundamental than the usual drives, and which account for the rats' performance on his battery of motivational tests. The problem needs further study. One would like to know more about these fundamental factors and their physical basis.

In the last analysis the energy with which we are concerned throughout this book is *physical*, and the conditions called *motivating* are those which release this physical energy and regulate the

direction of its expenditure. Physiologically, the energy is derived immediately from chemical reactions within the muscle cells and other cells of the body. The carrying on of these reactions depends in turn upon a supply of oxygen obtained *via* the lungs, upon the presence of intracellular enzymes, upon glycogen liberated from the liver and other food materials carried to the tissues in the circulating blood, upon the maintenance of a balance of endocrine hormones and many other vital chemical substances within the blood, and finally upon the maintenance of the physical conditions which favor life processes, in other words, health. A search of the organism for the fundamental sources of the energy that is expended when a muscle is moved would lead one to the many and complex bodily processes which constitute metabolism.

To recapitulate, motivation is the process of producing movement. In other words, it is the liberating of "bound" energy so as to induce reaction. The greater the amount of energy liberated in a given situation, the greater the degree of drive. *Drive is energy.*

Drive *versus* Drives. The *drive* of an organism, as we have seen, is the physical energy which makes it go. Current psychological usage, however, recognizes *drives* such as hunger, thirst, sexual, exploratory, and maternal drives. This plural use of the term at once raises the problem of defining a specific drive and differentiating among the ones commonly accepted.

If the meanings of drive listed on page 75 be carefully considered, it will be discovered that some of these describe behavior and others stress the conditions which cause or determine behavior. Some psychologists are inclined to hold to the purely descriptive usage, but the explanatory meanings of drive are too strongly entrenched to be lightly set aside. The explanatory meanings refer to the various organic conditions, the persisting environmental stimuli, and the mechanisms within the personality which cause, regulate, and control behavior.

Behavior is a process in nature which can be studied from many angles. The different definitions of drive presuppose various points of view. From one standpoint, drive is the general level of activity, the amount or quantity of behavior, quite apart from its purposes. According to this view the fundamental problem of motivation is to relate behavior to the conditions which determine the activity

level. From another standpoint, drive is purposive behavior. In this sense the sedentary thinker, for example, may be said to show drive even though he fails to expend much energy in behavior. From a third standpoint, drive is not behavior at all but rather something which explains or causes it. The different conditions in the tissues, the persisting environmental states, neural determinations—these somehow motivate or drive an organism. From a fourth standpoint, the one presented in the foregoing section, drive is the physical energy which makes the machine go. We have assumed only one kind of energy—physical energy; differentiation among drives is not possible from this point of view. We may say that individuals differ in the degree of drive or energy shown in their activity and that the drive of an organism varies with conditions, but when the word is used in this sense we cannot speak of different drives.

To talk about *drives* (in the plural) it is necessary to make distinctions. So far as differentiation of drives is concerned there are two main possibilities: first, to distinguish differences on the level of behavior, as, for example, that between food-directed and mate-oriented activity; second, to differentiate the more fundamental causes or conditions of behavior, as the persistent gastric contractions, the continuous excitations of cutaneous pain nerves. These are the behavioral and the physiological meanings of drive as distinct from the strictly physical or mechanical meaning.

Confusion about the definition of drive arises, not from any intrinsic disorder within the facts of drive, but only because there are diverse viewpoints. The sane solution is to recognize that differences of interpretation exist, and then to be clear about one's own position. To the *physical* psychologist, *drive is the energy* which moves the body. To the student of behavior, *drive is behavior,* whether considered as purposive or wholly lacking in goal orientation. To the physiological psychologist, *drive consists of bodily and environmental conditions*—or parts of them—which release energy and regulate the course of behavior. To the student of human personality, *drive is an assumed motivating factor*—a wish, purpose, set, interest, ideal—which controls the course of behavior.

When the present writer speaks of drive in the sense of physical energy he will use the term in the singular. When he speaks of behavior or of its determining conditions he will use the term in the

plural or in a collective sense. The organism, as a fact, exhibits various drives in behavior. Moreover, for any one of these the organic and environmental conditions are exceedingly complex. There are various driving mechanisms within the body; in the physiological sense these are the drives of behavior.

BODILY NEED AND HOMEOSTASIS

The drives which lead the organism to nutriment, to reproduction, to care of the young, and those which protect the body from all sorts of harmful environmental agents, are based upon physical and chemical conditions. For an organism to continue living and for the species to survive certain internal requirements must be met.

The Objective Criteria of Bodily Need. In all civilizations and in all climes human behavior is directed towards the relief of bodily needs. There are needs to eat, to drink, to eliminate wastes from the body, to regulate body temperature relative to the environment, to avoid injury, to procreate, to nurse the young, to breathe in oxygen, etc. The environmental conditions for meeting these needs differ widely from place to place and from time to time; social customs and taboos are distinctly variable; but the basic biological needs are constant factors in the situation. The student of human nature should recognize these dependable sources of motivation, and understand how, through a process of rationalization or self-justification, the facts are often distorted.

These basic human needs are dependable in the sense that they are invariably found where human life exists. They correspond to the physiological requirements for continued existence of the body cells and of the species. To be specific, water, protein, fat, carbohydrate, salts, vitamins, a certain temperature range, etc., are all essential to continued living of the tissues. The organism failing to maintain in the blood quite exact proportions of certain substances and to keep inner body temperature constantly within a narrow range of variation is soon eliminated in the struggle for existence.

The concept of bodily need can be defined objectively in terms of survival. The organism *needs* those substances and energies the withholding of which will lead to its death; it *needs* oxygen, nitrogen, calcium, and other substances to be present in the blood in certain proportions. Again, water is essential to the continued exist-

ence of an organism; and the permanent deprivation of water leads to an increasing water need until the organism dies. Physiologists have ascertained precisely and in great detail those conditions which are essential to the survival of the tissues, and their findings give us an accurate means of determining what does and what does not constitute bodily need.

Another possible way of defining bodily need objectively is in terms of the *optimal* conditions for survival, including growth, reproduction, health, etc. These optimal conditions imply relative freedom from the attacks of germs, freedom from nerve and muscle strain, a normal social environment, and other factors which favor physical and mental well-being.

Need, objectively considered, is not the same as conscious desire. A man dying of hunger greatly needs food, but during starvation the hunger pang ceases, the conscious desire for food being replaced by a sense of weakness, and the activity level drops to a very low point. During all of this the need for food increases steadily to the point of death while the conscious desire for food at first increases and then decreases. Less obvious needs, such as those for specific vitamins or certain minerals, may never take the form of conscious desires, even when the want is severe enough to cause serious illness or death. In such cases there is, instead, a general sense of ill-being, or weakness, or nervousness.

The definition of bodily need in terms of tissue requirements allows a distinction between objective need and the manifestations of need in behavior. For example, with the white rat, food deprivation raises the activity level for the first three or four days, but between the fourth and the eighth days the animal becomes increasingly weak and passive (pp. 117-119). Bodily need increases steadily to the point of death, but the way in which it shows itself in behavior is variable.

Homeostasis. Claude Bernard's conception of a stable *milieu interne* has recently been developed by Cannon, who demonstrated that the body maintains a highly constant internal physicochemical state despite changing environments. Cannon writes:

The constant conditions which are maintained in the body might be termed *equilibria.* That word, however, has come to have fairly

exact meaning as applied to relatively simple physico-chemical states, in closed systems, where known forces are balanced. The coördinated physiological processes which maintain most of the steady states in the organism are so complex and so peculiar to living beings —involving, as they may, the brain and nerves, the heart, lungs, kidneys and spleen, all working coöperatively—that I have suggested a special designation for these states, *homeostasis*. The word does not imply something set and immobile, a stagnation. It means a condition—a condition which may vary, but which is relatively constant.

As examples of homeostasis Cannon has shown that the blood tends to maintain approximately constant percentages of water, salt, sugar, proteins, fat, and calcium. To keep the chemical constitution of the blood constant it is necessary to have reserves in the tissues, and such reserves assuredly exist. The liver, for example, is a storehouse for sugar. For oxygen, however, an internal storehouse does not exist, because normally an ample supply is available in the air. Upon this external supply the organism draws constantly to maintain a constant percentage of oxygen in the blood. Again, there are bodily mechanisms which regulate the hydrogen-ion concentration of the blood and keep it close to neutrality. Still another illustration of homeostasis is found in body temperature. In health, the heat-regulating mechanism of the body maintains a temperature that is stable to within a degree, despite changing environmental temperatures.*

The principle of homeostasis is important in relation to bodily need. In the previous section it was stated that an organism must meet certain bodily needs in order to continue its existence. In the present section it is pointed out that the body fluids are remarkably stable chemically, and that the individual cells depend upon this constancy for their continued survival, taking up from the fluids those substances necessary for their nutritional wants. Thus, in the last analysis the maintaining of homeostasis is a process of meeting bodily needs.

A knowledge of the principle of homeostasis is important in

* For detailed consideration of the bodily mechanisms which maintain homeostasis, the reader is referred to Cannon's book, *The Wisdom of the Body*. New York: Norton. 1932.

understanding behavior and the mechanisms which regulate it. As Rignano has said:

> Every organism is a physiological system in a stationary condition and tends to preserve this condition or to restore it as soon as it is disturbed by any variation occurring within or outside the organism. This property constitutes the foundation and essence of all "needs," of all "desires," of all the most important appetites. All movements of approach or withdrawal, of attack or flight, of seizing or rejecting which animals make are only so many direct or indirect consequences of this very general tendency of every stationary physiological condition *to remain constant*. . . .

The same principle has been stressed by Raup in an interesting book upon complacency. Raup claims that the maintaining of equilibrium is the most basic principle, not of behavior alone, but of all life processes. Within every cell chemical equilibria are maintained. Furthermore, there are equilibria between adjacent individual cells, between groups of cells, between whole parts of the organism, and groups of parts. When nervous processes are considered, for example, this principle of equilibrium between antithetical reactions is repeatedly met. It is seen in the antagonism between groups of muscles, such as the flexors and extensors of the arm or leg, and in antagonistic reflexes such as the scratch reflex of the dog and the extensor thrust. The whole organism, indeed, depends for survival upon its functioning parts, and the parts upon the whole. Within the organism there is a hierarchy of equilibria in which the most basic processes depend upon the most incidental for proper operation, and the latter upon the most basic.

Raup has extended the principle of complacency to include behavioral adjustments of organism to its environment. The organism, in health, maintains a balance with its surroundings; this is the meaning of adjustment. Maladjustment, in Raup's opinion, is a disturbance of dynamic balance, equilibrium between organism and environment, or complacency. After such a disturbance, behavior shows a tendency toward a renewed complacency, or the restoration of equilibrium. Raup's hypothesis is very thought-provoking, presenting as it does an all-inclusive theory of motivation in terms of a tendency toward equilibrium.

Conclusion. The activity of living organisms can be analyzed into its component parts or treated as an integrated whole. The general level of integrated activity is shown outwardly by the total quantity of movement or else by the amount of work accomplished.

Activity level and energy expenditure are basic conceptions. The conditions which regulate them must be given thorough consideration in a fundamental study of motivation. Some of these conditions are environmental, some intraorganic, some both.

It is a basic physiological principle that organisms tend to maintain approximately constant physical and chemical bodily states, and that they must succeed in doing so if the individual organism and the species are to have optimal conditions for survival. From this it follows that protoplasm *needs* certain substances and energies from the environment. The evolutionary process has gradually developed bodily mechanisms well adapted to the satisfying of these needs. In maintaining homeostasis, drive plays a definite rôle.

What is drive? In the physical sense, drive is the energy which makes the machine go. In the behavioral sense, drive is goal-oriented behavior, or else the general level of activity whether purposive or not. In the physiological sense, drive is a tissue condition which gives rise to persistent stimulation, or else drive is the persistent stimulus (drive stimulus) itself. In the strictly psychological sense, drive is a motivating factor of personality—such as a wish, purpose, ideal—which regulates and directs one's conduct. Human and animal activity contains countless goals and hence innumerable drives. The examination of the most basic animal drives will be undertaken in the next two chapters.

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CHAPTER III

ANIMAL DRIVES

"The fact is that in all experiments upon animals, whether to determine their power of distinguishing stimuli or their power of learning by experience, the first requisite is to give the animal what we commonly call a *motive*."

—MARGARET FLOY WASHBURN

The experimental investigation of motivation has been carried further in the field of animal behavior than in any other branch of psychology. Why study the motivation of animals? All the careful, detailed work with the white rat may appear trivial and irrelevant to the layman who thinks of psychology only in terms of human values.

The question needs a moment of serious consideration. For one thing, man himself is an animal, and human behavior is to a large extent determined in the same manner as that of the other animals. The basic forms of motivation—hunger, thirst, the sexual urge, the maternal and exploratory drives, and so on—are common to man and brute. Just as the biologist studies growth, metabolism, respiration, reproduction, and many other processes not in the human species alone, but wherever they occur in nature, so the psychologist studies behavior and its determinants wherever the processes can be found. The truly scientific background and perspective for understanding human conduct are found in the study of the world of fact in the rich realm of animal behavior.

But there is a more practical reason for investigating motivation in animals. A great many researches upon sexual motivation, hunger, the effects of electrical shock, isolation, maternal behavior, and other fundamental problems can be carried on readily with animals which would be impracticable, taboo, or even harmful if conducted with human subjects. Surgical operations, carefully carried out with animals, involve risks of life which make such procedures wholly

out of the question in human research. Again, animal subjects can readily be obtained in large numbers, the conditions of an experiment can be rigorously controlled from birth to death, and—animals can be depended upon to keep their laboratory appointments! All these considerations favor the use of animal subjects for much psychological investigation.

This does not mean that work with human subjects should be neglected. The complete picture of motivational psychology is one in which man and animal are shown side by side, with their similarities or differences pointed out.

The investigations of animal and human motivation are at all points interrelated. The basic biological motivations are well adapted to investigation in the animal laboratory. The specifically human and the social forms of motivation such as craving for prestige, interests, desires, ideals, special hobbies, the incentives of praise, reproof, prizes, and so forth, can be studied to the best advantage with human subjects. Some of the latter forms of motivation scarcely exist at all on the level of brute behavior.

METHODS, APPARATUS, ILLUSTRATIVE RESULTS

The following study of experimental methods is limited to those used for the investigation of animal motivation. Distinctively human methods involving the use of mental tests, verbal instructions, psychoanalytical procedures, the control of social environments, *e.g.*, by the use of praise, rivalry, reward, and other incentives, are ignored here. They will be considered in later chapters.

A Classification of Methods. The methods employed in the study of animal motivation may be conveniently grouped as follows:

I. Activity methods (observing behavior with a view to discovering its causation).
   A. Field observations of behavior (migration, hibernation, mating, food-hunting, etc.).
   B. Laboratory observations upon:
      1. Specific activities (nesting, eating, drinking, urinating, defecating, nursing the young, preening, etc.), observed with various special forms of apparatus.

2. General activity level as observed with activity apparatus (rotating drum for running; stationary activity cage).

II. Counterbalance of motives (arousing in the animal at the same time two opposed determinations).
   A. The method of choice (opposing two different drives).
   B. The method of preference (inciting the same drive with two simultaneous goal objects).
   C. The obstruction method* (interposing an obstacle, such as an electric grill, between animal and goal).

III. Contrast of motives (arousing different determinations one at a time, and comparing the results).
   A. Methods maintaining a constant motivation throughout an experiment—the learning method, utilizing rewards or punishments.
   B. Methods introducing a shift of motivation during the course of an experiment.
      1. With completely learned activities.
      2. During learning.
      3. With unlearned activities.

There are various other procedures which have been, or can be, combined with any of the above methods. One of these is the use of surgical operations (*e.g.*, removing a gland, or a part of the brain). Another is the experimental control of environmental conditions, both physical (*e.g.*, temperature, movement of air) and social (presence of a companion or mate). Still another is the control of internal facilitating and inhibiting conditions by the use of drugs, variations in diet, etc.

The methods outlined above will now be considered in detail, with descriptions of the kinds of apparatus used and, in some cases, with a presentation of typical experimental results. These results, where given, should be considered, not only as illustrative of a method, but also for what they teach concerning motivation.

I. Activity Methods. Field observations upon the free and unrestrained activities of animals have thrown light upon motivat-

* Various kinds of obstructions have been interposed between animal and goal object. For example, a wall to be climbed, a detour, a maze to be learned, an enforced delay, a runway to be traversed, an electric grill to be crossed—all can be regarded as obstructions or obstacles to the goal-directed behavior of an animal.

ing conditions. These observations have revealed periodical and seasonal changes. The migration of birds, the hibernation of ground-dwelling animals, seasonal breeding, cycles of feeding and elimination—these and similar activities call for explanation in terms of the causal factors involved.

In the laboratory the "spontaneous" behavior of animals has been observed with carefully controlled conditions. In the preceding chapter the more important types of apparatus and laboratory methods used in studies of the activity level were described in detail, and typical results presented. No further space need be given here to the activity methods. An account of the remaining methods is given below.

II. Counterbalance of Motives. In the study of animal motivation one general method has been to bring two incompatible determinations into direct opposition in order to compare their relative strengths. Three forms of this method are described in detail:

A. The Method of Choice. The choice method may be illustrated by reference to the work of Tsai, in which sex and hunger motivation were opposed.

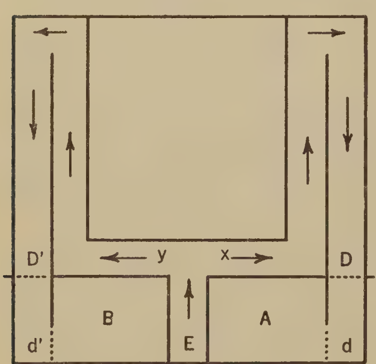

Fig. 21. Apparatus for the Study of Choice. (*After Tsai.*)

His apparatus, shown in Fig. 21, consists of two goal-boxes, *A* and *B*, at the sides of an entrance alley, *E*. From *E* the path bifurcates into *x* and *y* alleys. From *x* a path leads in the direction of the arrows to *A*, and from *y* another leads to *B*. The walls of the goal-boxes facing alleys *x* and *y* are made of wire mesh, so the animals can sense the contents of each. Doors, *D* and *D′*, can be closed by the experimenter to prevent the animal from retracing his path, and other doors, *d* and *d′*, serve to keep the mate confined.

In Tsai's experiment two groups of male rats were used. To one group were presented food in *B* and a mate in *A*; the other

group was presented food in *A* and a mate in *B*. For two weeks prior to the main tests the animals were given some food in one compartment every other day, and on alternate days they were allowed to remain half an hour with a receptive female in the other compartment. In this preliminary work the rats came to associate food and mate with particular compartments of the apparatus. After habituation the experimental tests were commenced.

With a twenty-four-hour food-deprivation period a rat was placed in the entrance alley and offered a choice between food and receptive female. Each rat was given five choices per day. When an animal entered a given compartment the door was closed immediately to prevent retracing, and he was allowed one or two minutes in the goal-box.

Results of the experiment are briefly as follows. Group I (nine rats) selected food in 78 per cent of the trials and the female in 22 per cent. Group II (ten rats) selected food in 76 per cent of the trials and the female in 24 per cent. The similarity of the findings for the two groups indicates that position-habit played a relatively small rôle in the choices. Tsai concluded that the hunger motive (twenty-four-hour) is stronger than the sex motive in the albino rat, as measured by the method of choice.

One difficulty with the method lies in the control of physiological conditions. Sexual urge and food hunger are both complex; the compound state presupposed by the choice experiment is doubly complex. For one thing, sexual motivation is known to be weakened by hunger (pp. 146-147), and by certain emotional conditions. These and other complications make it difficult to control the physiological state of the animals quantitatively.

B. The Method of Preference. The preference method, like the foregoing one, is beyond doubt based upon choosing; but whereas Tsai's method of choice involves two basic drives (sex and hunger), the preference method is commonly limited to a choice between goal objects which arouse one and the same drive.

The author's apparatus for studying food preferences is diagrammed in Fig. 22. It consists of a starting box, *B*, connected by a single plank, *R*, which serves as a runway, to the wire-mesh feeding plate, *P*. A sliding door, *D*, controls the exit of an animal from *B* to *P*. Placed in the central opening of the feeding plate are two

glass tubes leveled off to the top with foodstuffs. The entire apparatus is surrounded by an opaque screen, *S*, except for a small window through which the experimenter at *E* observes the rat's behavior.

At the start of an experiment a rat is placed in the starting box. When the tubes of foods are in place the door is raised and the animal is free to come to the food. As soon as he makes contact with one food-substance the critical observation commences. The rat is given a fixed time in which to eat—one to four seconds in our experiments, at the close of which the food tubes are promptly lowered out of reach beneath the feeding plate. The rat is trained to return to his box, and the door is closed after him by the experimenter. Immediately the tubes are interchanged in position by the 180-degree rotation of a small, central turn-table. The foods are again leveled off, and the door opened to admit the rat for the next trial. When the rats were habituated to the apparatus, and if the two foods being used included something they liked, they would run through a long series of trials rapidly, making as many as sixty choices in twenty minutes. The technique involves no handling of the animal during the fifteen- or twenty-minute observation period.

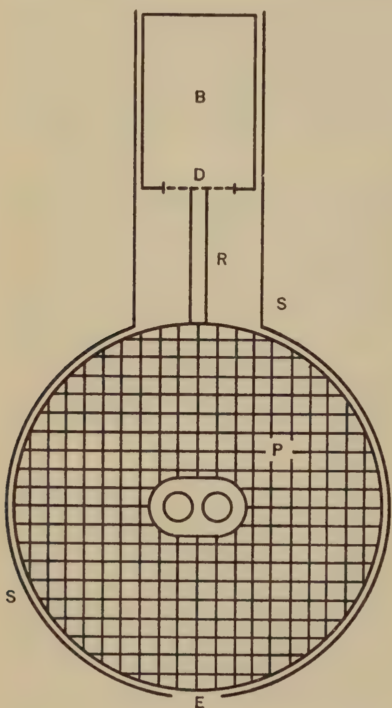

Fig. 22. Apparatus for the Study of Food Preferences.

This procedure gives a continuous series of preferential discriminations between two test foods. By pairing a selected group of foods in all possible combinations a preferential series for the rat can be worked out. Results of the method are described on pp. 109-113.*

* A preference method was formerly used by Vitus Graber and others to study the organism's ability to discriminate between different stimuli. Washburn has pointed out that for the study of discrimination the method is faulty. Although preference presupposes an ability to discrim-

Certain variations of these methods utilize several conflicting motives. Harlow, for example, performed a preference experiment in which rats were given a free choice among four kinds of food presented simultaneously, in the four corners of a compartment.

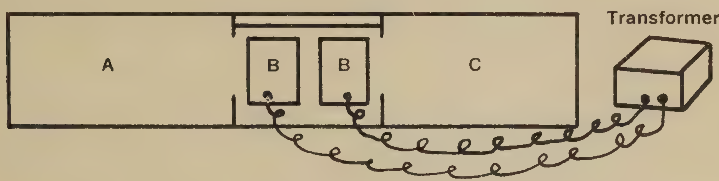

FIG. 23. THE ELECTRICAL OBSTRUCTION APPARATUS OF MOSS.
An electrical grill of two plates (*BB*) is interposed between the animal (*A*) and the goal (*C*).

C. The Obstruction Method. In his study upon drives, Moss used an apparatus of the type diagrammed in Fig. 23. The animal was placed in one compartment (*A*) and the goal object in another (*C*). For the animal to reach the goal it was necessary for him to cross the plates at *BB* and receive an electric shock. The voltage of the current was controlled by a transformer.

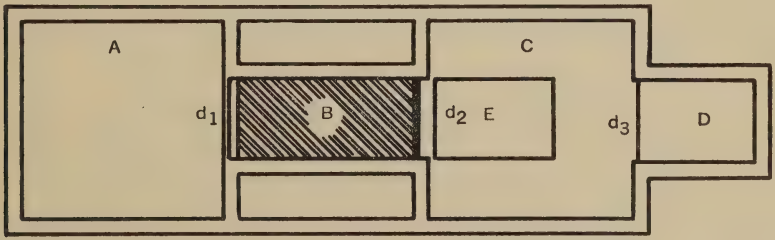

FIG. 24. COLUMBIA UNIVERSITY OBSTRUCTION APPARATUS. (*After Jenkins and Warden.*)

This type of apparatus has been much improved, and standardized, by Jenkins and Warden. The ground plan of their Columbia University obstruction apparatus is given in Fig. 24. *A* is the entrance compartment in which the rat is placed; *B* is the obstruction compartment, which has an electric grill on the floor; *C* and *D* together constitute an incentive compartment. The goal object—

inate, it is quite possible for this ability to be present where a preference does not exist. However, for the study of preferences *per se*, the preference method is the only form available, and when used with careful control of conditions is free from the objections formerly raised against it.

food, water, mate, etc.—is kept in *D*. Doors at d_1, d_2, and d_3 are used to control the movements of the animal in the apparatus. The door at d_1 is kept closed until the experimenter is ready to begin an observation. A hinged release plate, *E,* automatically operates the door at d_3, thus liberating the mate from *D* in experiments with sexual motivation.

In a more recent form of the apparatus, compartment *D* has been dropped, and glass plates are used so that the behavior of the animal is clearly visible from the side rather than from above. An electrical unit for precise control of the current in the grill has been developed.

The Columbia apparatus has been used extensively by Warden and his collaborators in studies which will be referred to later. The experimenters have demonstrated that crossing the grill is a valid indication of the presence as well as a measure of the strength of hunger, thirst, sex, and other drives. Repeated crossing of the grill by the rat does not occur in the absence of a motivating bodily state, nor in the absence of its appropriate goal object.

In recording results every crossing of the grill, contact with it, or approach to it was originally counted. It now appears that the frequency of crossings per unit time is a sufficient measure. The statistical reliability of these measures was determined for the different drives by making retests.

When a rat is placed in the obstruction apparatus he is confronted with a goal but the direct path leads across the charged grill. A conflict is thus established in the animal between the urge to attain the goal and the drive to avoid the electric shock, and the relative strength of the two motives is measured by the frequency with which the rat crosses the grill in a twenty-minute period. If a drive is sufficiently potent, a rat will cross the grill and take the shock; and it is assumed that the more intense the drive the more frequently will he cross per unit period.

Regarding the method Warden writes: "The behavior of the test animal must result from some sort of balancing of the positive influence of the incentive and the negative effect of the obstruction. The two factors are so interpenetrated in their actual operation that it is difficult if not impossible to evaluate them independently in a satisfactory manner."

One difficulty with the obstruction method is this: as the animals become adapted to the shock it furnishes less and less resistance to a given drive. The electrical obstruction is physically constant, but in terms of behavior it is a variable. In other words, the drive being tested is measured with a somewhat elastic yardstick.

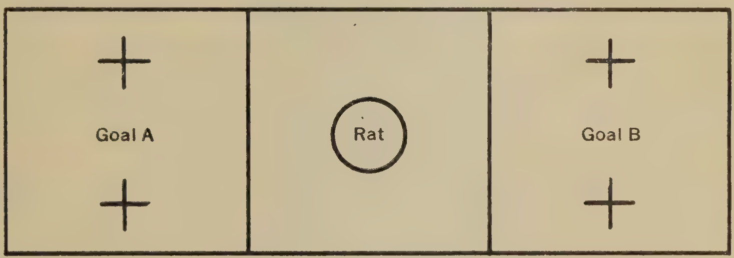

FIG. 25. MOTIVATING SITUATION FOR CHOICE AND PREFERENCE EXPERIMENTS.

The above forms of the counterbalance-of-motives method can be represented schematically, borrowing Lewin's conception of positive and negative valence, as in Figs. 25 and 26. In the method of choice the rat is placed between two goal objects both of which have for the animal a positive valence. See Fig. 25. In one of Moss's experiments the choice was between two negatives: remaining in

FIG. 26. MOTIVATING SITUATION FOR OBSTRUCTION EXPERIMENTS.

ice water or crossing a charged grill. In the method of preference the diagram is the same. It is true that, in the writer's preference set-up, the test foods are very close together in space, but the principle of choice is the same as in Tsai's experiment.

In the obstruction method the goal object has a positive valence, but the direct path is over a grill with negative valence. See Fig. 26. This arrangement of valences holds good for all studies by the Columbia obstruction method.

A general difficulty with all methods in which counterbalance of motives is used lies in the interaction of the motives each upon the other. Thus, in discussing the method of choice it was brought out that hunger weakened the competing sexual motivation (see p. 91). Similarly, with the method now under discussion, the fear of the grill, a pain-avoidance reaction, tends to inhibit the bodily processes of hunger, as Cannon and others have shown. Thus the very motivation which the method aims to measure is weakened or destroyed. Despite this difficulty, the counterbalancing of motives has yielded consistent and highly significant results.

An interesting class-room demonstration based upon the obstruction method can be made with the apparatus shown in Plate III. In this demonstration a horizontal metal tank with a glass front is placed on the lecture table. (See the lower view.) A rat, previously trained to cross the uncharged grill and reach the food, is introduced at the left. After the rat has crossed the grill and nibbled at the food he is lifted back for another trial. This is repeated a time or so.

Now the stage is set for observing the initial effect of introducing the electric charge and for studying the process of the building up of inhibitions. The strength of the charge is regulated by the variable resistance coil shown in the upper view.* In giving a demonstration the first shock used is very weak. This is likely to make no apparent difference in the rat's crossing behavior. However, when the trials are repeated with a gradually increasing strength of current, the avoiding responses to the charged grill become more and more apparent. It is easy to see that as the charge is increased the rat becomes more and more inhibited in his urge to reach the food and eventually ceases to cross. He finally stays, as if afraid, to the left of the charged grill, possibly approaching or contacting the grill but not crossing over.

III. Contrast of Motives. The above methods are based upon a counterbalancing of motives. Another group of methods utilize various motivating factors *one at a time*, contrasting the varying

* The 110-volt alternating current is passed through this variable resistance and through a series of three carbon-filament lamps. The grill is on a shunt which commences before and terminates just after the variable resistance.

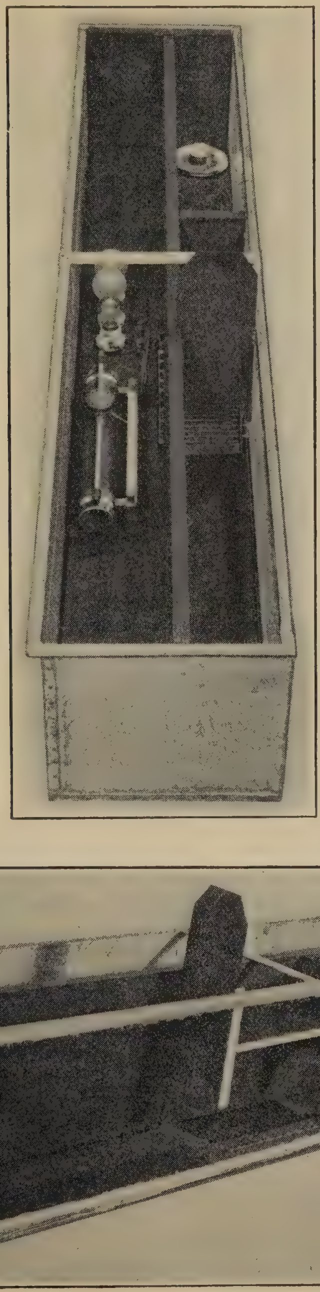

PLATE III. OBSTRUCTION APPARATUS USED AT THE UNIVERSITY OF ILLINOIS FOR CLASSROOM DEMONSTRATIONS.

results in behavior. The commonest form is known as the learning method.

A. The Learning Method. In most of the experimental literature upon animal learning, motivation is viewed merely as a means to an end. There is, however, a considerable and rapidly growing body of literature concerned primarily with the effectiveness of various kinds of motivation in inducing learning. In the investigations to throw light upon motivation for its own sake, different kinds and combinations of incentives, and varying intensities of the same incentive, have been studied. The experiment of Simmons is an excellent example (p. 297).

Another illustration is found in a brief study by Stone and Sturman-Huble in which two groups of rats were trained to run the maze. One group was motivated by food hunger and the other by sex hunger. The writers concluded tentatively that with one-year-old male rats food and mate were approximately equal as incentives to maze learning. It is clear from other work, however, that the truth or falsity of this conclusion depends wholly upon the degree of hunger and upon the strength of the sex urge.

Since most of the experiments upon punishment and reward (pp. 278-306) illustrate the study of motivation by the learning method, no further examples need be given here.

B. The Shift-of-Motivation Method. A variation of the learning method is found in the work of Elliott, in which the motivation was suddenly shifted during the course of learning.

His rats were given one trial per animal daily in a maze. One group of animals was rewarded with sunflower seeds throughout the entire learning period. The other group was rewarded with bran mash for the first nine days of the experiment, and on the tenth and succeeding days the reward was changed to sunflower seeds. The first group served as a control, and the second as an experimental group to study the effect of a shift of motivation.

The error curves are shown in Fig. 27. Ordinates give the average number of errors for each group; abscissae mark successive days of the experiment.

The figure indicates that the experimental group learned more quickly than the control group until the tenth day. When the re-

ward was changed on the tenth and following days, the number of errors increased markedly beyond that of the control group. Elliott interprets this result in human terms by saying that the rats *expected* a specific reward rather than mere satisfaction of hunger and that the strangeness and startle resulting from finding a new kind of food explain the poor performance after day ten.

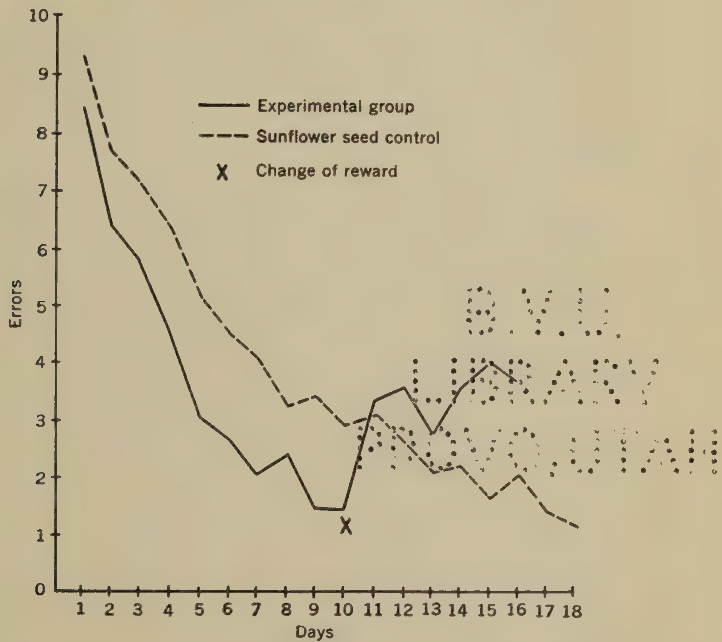

FIG. 27. MAZE LEARNING WITH CHANGE OF REWARD. (*After Elliott.*)
The dash-line shows the error curve for the control group of rats, which learned the maze with a reward of sunflower seeds. The solid line gives the error curve for the experimental group. At *X* the reward was changed from bran mash to sunflower seeds.

It is likely also that bran mash would rate higher than sunflower seeds in a direct preference test. In any case, Simmons' experiment gave sunflower seeds a relatively low rating (p. 297). One can, of course, argue directly from Elliott's curves during the first nine days, that since the bran mash brought quicker learning than the sunflower seeds, it is the more preferred of the two. The writer has repeatedly observed that the more preferred of two foods gives the quicker learning. It is regrettable that Elliott did not carry along a third group of rats which was first fed on sunflower seeds and

changed on the tenth day to bran mash. Such a group would have shown the relative importance of the two factors contributing to the rise in the error curve: (1) the disturbance occasioned by changing the reward, and (2) the relative preferredness, to rats, of the two foods used.

Another illustration of the method in which incentives are shifted is found in an unpublished experiment performed at the University of Illinois by Seymour Stein under the writer's supervision.

A ground plan of the apparatus is presented in Fig. 28. It consists of two feeding boxes connected by a runway. At the ends of the apparatus are two food cups which can be lowered through the floor out of reach of the rat. The cups are arranged on a teeter-

FIG. 28. FOOD-INCENTIVE APPARATUS.*
The explanation is in the text.

totter device so that when one is up the other is down, and *vice versa.* When a food cup is moving downward, the opening in the floor closes automatically, to prevent the animal from reaching the food through the hole. The floor is made of wire mesh so that food will drop through, if spilled.

In using the apparatus a rat was permitted to eat out of a cup for five seconds; then the food was removed. By running to the other feeding box the rat again had opportunity to eat for five seconds. Each rat was observed for exactly fifteen minutes daily, and the number of runs per minute was tallied.†

The plan of the experiment was to train an animal to the limit

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* The boxes are 7½ inches square; the connecting runway is 10 inches long; the food cups have an inside diameter of 1½ inches.

† Some difficulty was experienced by a tendency of the rats to fill their paws with food just before the cup was removed, and then to continue eating for a number of seconds after the lowering of the cup, before crossing over to the other food box. This behavior, unfortunately, introduced an uncontrolled factor into the results, by reducing in some cases the number of crossings per fifteen-minute period.

of practice with a given food incentive, and then suddenly to shift to another food of known preferential rating. It was found, in general, that foods which had rated relatively high when tested by the preference technique, produced more crossings per fifteen-minute period than foods relatively low on the preferential scale.

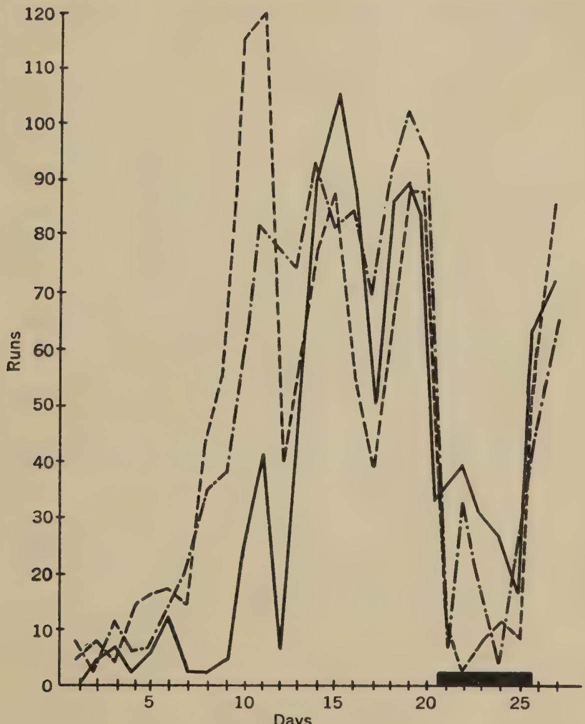

FIG. 29. CURVE OF ACTIVITY IN FOOD-INCENTIVE APPARATUS.

Ordinates give number of runs per fifteen-minute period; abscissae give successive days. Shading on days 21-25 indicates use of butterfat as an incentive. On other days the regular diet was used.

Figure 29 presents graphically the results of one series for three male rats. These animals ran the apparatus on the first twenty days with the standard laboratory diet as an incentive. On days 21 to 25, inclusive, pure butterfat was substituted for the dietary mixture. On days 26 and 27 the standard diet was again presented. After each daily series throughout the experiment the animals were individually given a measured ration of the standard diet and returned to the living cage.

Figure 29 shows: (1) An initial increase in the number of runs per day as the rats learned to run the apparatus. The approximate limit of practice was reached in about fifteen days. (2) An abrupt decline in the activity level when butterfat was substituted for the regular diet. In a previous study butterfat was shown to have a relatively low preferential rating whereas the dietary mixture stood considerably higher in the scale. (3) An abrupt rise in activity to its earlier high level when the standard diet was again used as an incentive.

Entirely in harmony with these results were those obtained in another experiment in which six rats individually showed a marked drop in the activity level when ordinary flour was substituted for fresh milk as the reward. Milk was previously found to be decidedly preferred to flour in our direct preference test.

An interesting finding in connection with this work is that the activity level gradually lowers as an animal approaches satiation. Runs were tallied for three successive five-minute periods. With ground whole wheat as a reward, a group of three rats gave the following total number of crossings for a period of fifteen consecutive days:

Total Number of Crossings on the Food-Incentive Apparatus During a Fifteen-Minute Period		
First 5 minutes 893 crossings	Second 5 minutes 644 crossings	Third 5 minutes 577 crossings

These activity gradients, or satiation curves, vary with the kind of food, the apparatus used, the degree of hunger, and other conditions.

As a final illustration of the shift-of-motivation method brief reference is made to Wever's investigation upon the rate of swimming in relation to water temperature. He placed rats in a tank of water, the temperature of which he varied from time to time. With each temperature he measured the rate of swimming (see pp. 61-63 for fuller details).

Swimming, in the rat, is an unlearned activity. When an animal,

for the first time in his life, is placed in water he swims almost immediately. He may stretch out his legs helplessly for a few seconds, but after that he swims effectively.

Obviously, all these experimental methods have one feature in common: the deliberate shifting of motivating conditions in the course of an experiment for the purpose of contrasting their effectiveness. Whether the shift is made with a learned activity, an unlearned activity, or during the process of learning, is secondary to the main feature: the shift of motivation to study the effect of the shift upon behavior.

THE PRIMARY DRIVES

An organism lives only when it can obtain food, water, air, freedom from trauma, moderate temperature, rest, sleep, etc. A species continues only when reproduction is possible. Some of the types of behavior which serve the biologically fundamental ends are considered in the following sections.*

I. Hunger and the Regulation of Eating

The Bodily Basis of the Hunger Pang. In a well-known experiment Cannon and Washburn have described the conscious hunger pang in the following words: ". . . a dull ache or gnawing sensation referred to the lower mid-chest region and the epigastrium. It is the organism's first strong demand for nutriment, and, not satisfied, is likely to grow into a highly uncomfortable pang, less definitely localized as it becomes more intense."

This pang occurs simultaneously with stomach contractions, as the work of Cannon and Washburn, Carlson, Wada, and others has shown. The method commonly used to record gastric hunger contractions in the human subject is pictured in Fig. 30. During an experiment the subject trains himself to swallow a tube to which is attached a rubber balloon. When in the stomach the balloon is inflated, and then the tube is connected to an apparatus which gives a graphic record. The subject presses upon a signal key whenever he experiences a hunger pang.

This experiment is interesting because it demonstrates a correla-

* In the following pages those sections which are printed in solid blocks may be omitted without loss of the main line of thought. They deal with details of animal research.

tion between the conscious hunger and its bodily counterpart. The hunger experienced by the subject is assumed to depend upon the gastric contractions.

Physiologists have distinguished hunger from "appetite." The term "appetite" was used by them because of a need to explain several well-recognized (although psychologically heterogeneous) facts

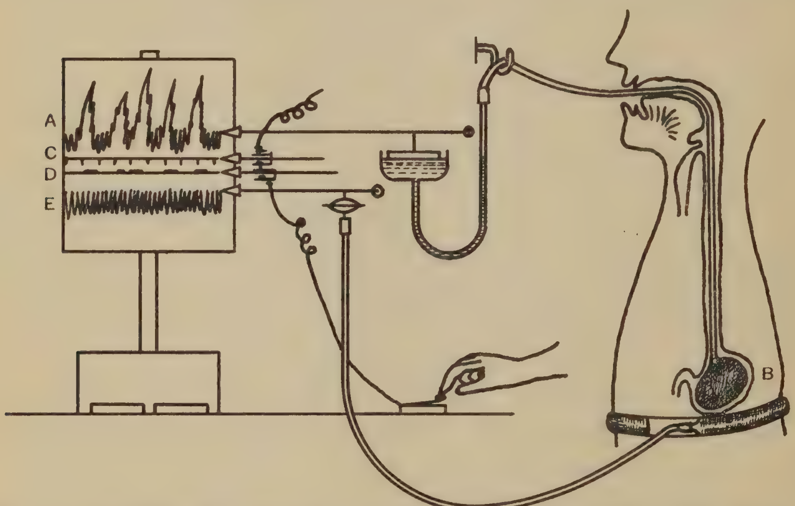

Fig. 30. Apparatus for Recording Gastric Hunger Contractions. (*After Cannon.*) *A* is a kymograph record of the increase and decrease of air pressure within the gastric balloon, *B*. *C* is a time record in minutes. *D* is a record of the conscious hunger pangs experienced by the subject. *E* is a record from a pneumograph placed around the subject's waist to show that hunger contractions are independent of the respiratory movements of the abdominal wall.

which were not included within the concept of hunger. Among these facts are: (*a*) that previous experience with the taste and smell of a food modifies one's liking or disliking for it; (*b*) that one eats candies and other dainties "to please the palate" even when not hungry; (*c*) that the conditions under which food is served—table linen, silver, guests, etc.—modify one's liking or disliking; (*d*) that the anticipated pleasure of eating depends upon a different motivation from the pain of hunger.

In Cannon's recent book, *The Wisdom of the Body,* is a statement that ". . . the person beset by an appetite is tempted, not driven, to action—he seeks satisfaction, not relief." But he adds: "It is not to be supposed that the two motivating agencies—the pang and the

pleasure—are as separate as we have been regarding them for purposes of analysis in the present discussion."

Again, Carlson has pointed out that man may eat from habit or from a sense of duty, in the absence of both hunger and appetite. This statement seems to imply several determiners of eating—hunger, appetite, habit, sense of duty.

The physiological conception of appetite as one of the factors which regulate the process of food-taking has never been clearly defined. Mursell has made the valuable suggestion that food-seeking behavior be regarded as a unit which depends upon a variety of factors. If we ask, "What are the factors which regulate the ingestion of food?" the following desultory list can be offered as a partial answer: (1) the immediate excitation of the sensory receptors, especially in the organs of taste, smell, and touch (including temperature); (2) pleasantness or unpleasantness experienced in eating certain foods; (3) special cravings and aversions for foodstuffs (considered below); (4) previous conditioning to specific foods; (5) general metabolic state of the organism as determined by the previous diet, state of health, etc.; (6) gastric hunger contractions and the associated energy releases; (7) environmental conditions—social and non-social; (8) sense of duty and similar mental determinants. All these points might well be expanded.

Free-Choice Feeding Experiments. Countless years before the scientific study of nutrition, animals selected their diets from the available food supply and for the most part grew, reproduced, and maintained themselves in health. The view that an animal is able to select a diet adequate to its bodily needs when given a free choice among a variety of foods is supported also by experimental evidence. From an extensive literature several examples are cited.

Evvard* gave pigs a free choice among a variety of foods and found that they selected a diet adequate to their bodily needs and gained rapidly in weight. He states: "The appetite of the pig appears to be a very good guide as to bodily needs; hitherto the apparent reliability of the appetite has not been duly appreciated." Incidentally he noted that the food preferences of the pig changed as growth altered its needs.

Nevins gave dairy cows opportunity to select their own rations

* The material in this and the following section has been taken from the author's paper, Food Preferences and the Regulation of Eating, *q.v.* for references to the studies cited.

and found that they tended to eat more than enough to meet their requirements for maintenance and milk production; that they laid on additional weight. Food preferences of the cows, he observed, changed frequently and decidedly; no two animals exhibited exactly the same preferences for all foods; there were sudden variations in the relative preferences for certain food substances.

Price offered chickens a choice between three kinds of butter: (1) butter high in vitamins A and D, (2) butter high in A but low in D, (3) butter low in both A and D. He found that the chickens ate the greatest quantities of the first food which, of course, is the most adequate to meet their bodily needs. He does not know how the foods were discriminated, for to the human observer the flavor and odor gave no clue, and the containers, which were of the same size and shape, were shifted in position frequently and in a haphazard manner.

In the careful studies by Osborne and Mendel, and by Mitchell and Mendel, rats and mice were given a choice between adequate and inadequate diets. The animals selected the diets which were the most favorable to growth. Osborne and Mendel noted that the "desire of a young animal for food is something more than the mere satisfaction of its calorific needs. The demand made by the growth impulse must also be met by a food of the proper chemical constitution."

Davis performed a self-feeding experiment on three newly weaned infants, eight to ten months of age. Two of the babies were allowed to select their diet for six months and one for a year. A variety of raw or plainly cooked foods was used. Foods were presented in sauce dishes of standard size and liquids in glasses on the tray. The infant was permitted to eat with his fingers or in any way he could without correction of his manners, and was given free choice of foods. Arrangement of the foods on the tray was presumably haphazard. Davis writes that the infants "were able from the first to select their own foods from a list of simple natural ones and in quantities sufficient to maintain themselves with apparently optimal digestive and good (so far as immediate results could be judged) nutritional results. They were omnivorous and in eating were governed not only by their caloric needs, but showed definite preferences, which however, changed from time to time and were unpredictable." The experimenter does not know what influenced the initial choices

of the infants but, "There could be no question, however, that after the first few meals the foods wanted were promptly recognized and chosen, as they were reached for without hesitation no matter what was their location on the tray, others nearer at hand and brighter in color often being neglected. Each infant in the beginning chose some foods which, after he had gotten them into the mouth, he spat out. Later, this did not happen." The infants slept well, were sound, happy, energetic, full of "pep," and gained in weight more rapidly than the average gain specified by the Children's Bureau for this growth period. According to the report one child had rickets at the start of the experiment; he selected cod liver oil regularly, and when cured no longer took it. "A tendency was observed in all infants to eat certain foods in waves, i.e., after eating cereals, eggs, meats or fruits, in small or moderate amounts for a number of days, there would follow a period of a week or longer in which a particular food or class of foods was eaten in larger and larger quantities until astonishingly large amounts were taken; after this, the quantities would decline to the previous level." In the diet kitchen such waves were known as "egg jags," "meat jags," "cereal jags," etc. Dr. Davis presents graphs to illustrate these waves. The graphs should be compared with the curves presented by Evvard, Nevins, and others, and with the writer's curves of preferential trend (p. 112).

Although the above experiments upon free-choice animal feeding have been carried out in the field of nutrition rather than psychology, they nevertheless reveal principles which are important to the student of hunger motivation. They show that animals and infants are able to select adequate diets, if the necessary supply of foods is at hand. The studies further demonstrate the intimate relation between food preferences and nutritional needs.

Cravings and Aversions for Foods. In the discussion of homeostasis it was pointed out that an organism maintains a relatively constant internal state, and to do this, requires water, salts, proteins, carbohydrates, fats, and vitamins. A deficiency of some essential substance in the diet, and hence in the tissues, may cause a specific craving to appear. The case of water deficiency and thirst is an obvious illustration.

Another example is salt hunger, which has been described by Carlson and others. When animals are deprived of salt in their diet

they demonstrate an urgent craving for the substance, and will travel many miles to the "salt licks," if necessary, to satisfy it.

Green has described a peculiar craving of cattle in South Africa due to phosphorus deficiency in the soil, and consequently in the diet. This lack of phosphorus leads the cattle to eat bone. Green states that young cattle brought up in an area carefully cleaned of all bone débris showed osteophagia the first time bones were displayed. In extreme cases there was a tendency to chew wood, eat leather or dirt, pick up stones and swallow them, or to eat almost anything. This "depraved appetite" is one of the symptoms of osteomalacia, a disease characterized by softening or decalcification of the bones. It has been produced experimentally in cattle, by giving a diet deficient in phosphorus (and possibly also in other minerals) and can be cured by giving the affected animals bonemeal or phosphorus in some other form.

There are various other interesting instances of parorexia occurring as the symptom of a diseased condition. Grass-eating of carnivora in case of sickness is well known. Wool-eating by sheep is an abnormality said to depend upon a mineral deficiency in the diet. Eating of feces and infantophagia occur in some species as definite perversions. *Pica* is the eating of clay, chalk, earth, or other kinds of indigestible material. In severe cases of uncinariasis (hookworm disease) the patients are said to eat earth, paper, chalk, starch, hair, and clay; in our southern states the "dirt-eaters" are sufferers from hookworm disease. In chlorosis, an anemia occurring in young girls, there are capricious cravings, especially for sour and highly spiced foods, and sometimes even for chalk or earth. It is well known that unusual food cravings often appear during pregnancy in the human individual. All these abnormal cravings vanish when health or a normal physiological state is re-established.

R. Turro (according to a statement by Mursell) has argued for the existence of specific hungers for proteins, salts, fats, carbohydrates, etc. There are also specific aversions. Regarding one of these Sherrington wrote: "Few dogs, even when hungry, can be prevailed upon to touch dog's flesh as food. Almost all turn from it with signs of repugnance and dislike. . . . Some odour attaching to the flesh seemed (in an actual test) the source of its recognition." But an experiment by E. S. Girden at the University of Illinois has shown that the aversion, though quite common, is not universal.

When it exists it may be destroyed by hunger or by habituation to dog meat.

The existence of specific cravings and aversions suggests that special bodily mechanisms regulate the selection of food in health and disease. Regarding the detailed nature of these mechanisms we are mainly in the dark, and a vast amount of experimental work undoubtedly will have to be accomplished before the bodily processes can be understood.

Food Preferences. One frequently hears it said that there is no accounting for tastes, but the remark is false, at least in respect to the food preferences of the white rat. Working with a group of ten rats in a direct preference test (described on pp. 91-92), the author used as test materials the following foods: fresh milk (M); cane sugar (S); ground whole wheat (W); dried whole milk (D); white flour (F); pure butterfat (B).

The preferential sequences obtained in this experiment are summarized below:

Rat 40	S	M	W	D	B	F
" 41	M	S	W	D	B	F
" 42	M	S	D	W	F	B
" 43	M	S	D	W	F	B
" 44	M	S	W	D	B	F
" 45	M	S	W	D	F	*
" 46	M	S	W	D	F	B
" 47	M	S	W	D	B	F
" 48	M	S	W	D	F	B
" 49	M	S	W	D	F	B
Total group	M	S	W	D	F	B

* Died before series with butterfat.

The foods in the first column were the most highly preferred by the rats; those in the last column the least preferred. For each animal, any given food was preferred to all those in the same row to the right of it.

In these typical results the uniformity is much more striking than the differences. The preferential sequence for the total group, given

in the bottom line of the table, is strikingly similar to each of the sequences for the individual rats. Some foods which are adjacent in the preferential sequence for the total group differ from rat to rat in their relative locations; but foods remote in the group sequence are never interchanged.

Fig. 31. Hypothetical Representation of Group Uniformities and Differences in Food Preferences. (*Explanation in text.*)

The facts can be adequately pictured if we borrow a term from Tolman, and imagine a continuum of *demand* extending from the highest positive value at the top, through indifference, to the lowest negative value at the bottom. Figure 31 shows this continuum as a vertical line, with an arbitrary scale marked upon it.

The conception of demand is essential for an understanding of the picture. To make the matter clear, consider the behavior of rat 48 in our experiment, tested with a variety of foods. Results indicated the following preferential sequence:* fresh milk > sugar > ground wheat > dry milk powder > white flour > butterfat. The series was found to be transitive in the sense that every food was preferred to all the foods below it. As to butterfat, the rat became markedly negative towards it by the fourth day. On the fifth and following days he approached this food in a cautious, sniffing-the-air manner, and then turned aside as if repelled by it. He ate neither of the two test foods when butterfat was presented, but acted as if he were nauseated; he avoided the fat and remained inactive and sluggish. This distinctly negative pattern of behavior persisted despite the twenty-three-hour period of food deprivation.

The behavior of this animal throughout the total experiment is best summarized by stating that fresh milk was more highly demanded than sugar, sugar more highly demanded than ground wheat, and so on; that the demand for white flour was relatively slight, whereas that for butterfat, slight at first, came to be actually

* The symbol ">" should be read "is preferred to" or "dominates."

a negative demand, an aversion. The writer assumes that for a given metabolic state and a given food substance there is a definite, fixed degree of craving or of aversion. The term "demand" is used in a general sense to include all possible degrees of craving and aversion.

It is assumed that if demand values for any given food could be measured accurately for a group of rats, the results would take the form of a normal distribution curve upon the scale. In Fig. 31 each bell-shaped curve represents a hypothetical normal distribution of demand values for a group of animals tested with a single food. The overlapping of these bell-shaped curves portrays the experimental findings. The group as a whole is fairly uniform in the degree of demand for a given food, but individuals within the group may disagree as to the preferential order of the test foods.

The diagram presupposes that some *absolute* measure of the demand for a single food exists, whereas the preference technique actually reveals only *relative* differences of demand for the foods tested. One must not infer, from the diagram, that the location of a food upon the scale is fixed. Indeed, a food may shift up or down the scale with variations of diet, health, or general metabolic condition of the animals tested.

Such shifts of relative preference have been repeatedly demonstrated. The writer found that, when preference tests were made daily for a week or more, one of the foods gave a relative increase and the other a relative decrease of demand. To designate these gradual changes the phrase "preferential trend" was coined.

Figure 32 shows what happened when ground whole wheat and cane sugar were presented on the preference apparatus. The ordinates give the percentage of trials indicating sugar preference (below) and wheat preference (above). Each percentage plotted on this graph is based upon 250 preferential discriminations (10 rats, 25 trials each). The eight percentages in the graph are the results of eight successive groups of trials.

When milk and sugar were opposed with nine of the above rats (the tenth having died) the result was different, as shown in Fig. 33. Note that when sugar was opposed to wheat the trend was towards an increasing demand for sugar; but when sugar and milk were opposed the demand for sugar declined and that for milk increased. The trends usually moved consistently in a given direction; the preferred food became increasingly preferred.

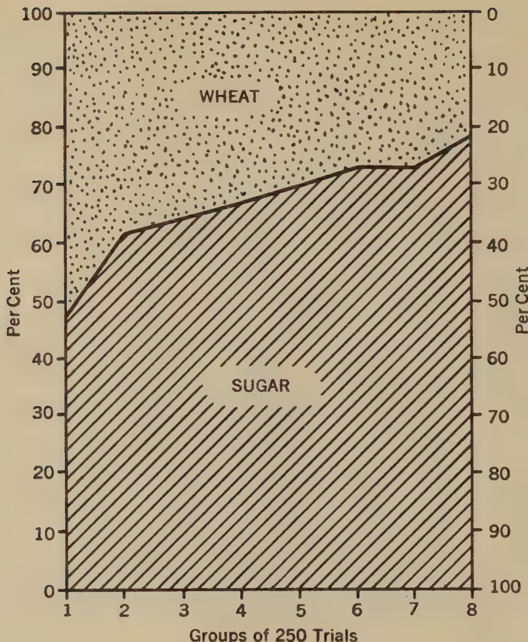

FIG. 32. PREFERENTIAL TREND OF WHEAT AND SUGAR (*explanation in text*).

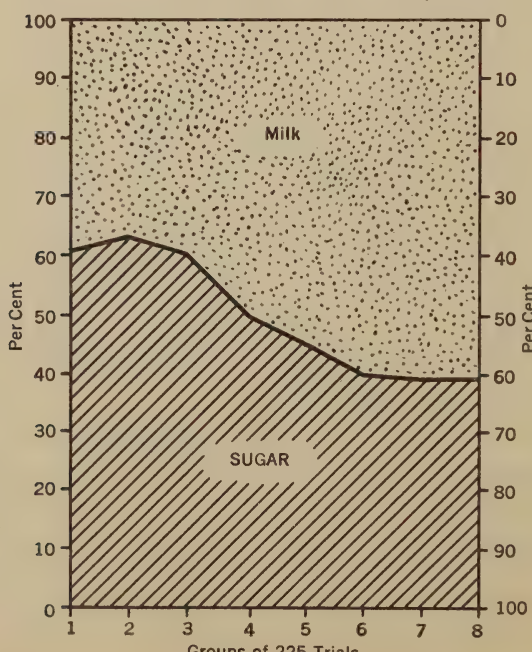

FIG. 33. PREFERENTIAL TREND OF MILK AND SUGAR (*explanation in text*).

It is difficult to know how far the preferential trend is a matter of learning, and how far it is a matter of chemical adaptation to the foods. Whatever the interpretation, the facts are the same: with adaptation the preferential relations gradually change.

Sometimes the mutations of preference were found to be fairly abrupt, and were readily observed in the course of an experimental hour. One instance of this is reproduced in the following table, which shows the successive preferences of a male rat on the fifth day of an experiment using butterfat and wheat.

Food Preferences Manifest in Successive Trials

1	B	14	W	27	B
2	W	15	W	28	B
3	B	16	B	29	B
4	B	17	B	30	B
5	B	18	W	31	B
6	W	19	B	32	W
7	B	20	B	33	W
8	W	21	B	34	W
9	B	22	B	35	W
10	B	23	B	36	W
11	B	24	B	37	W
12	B	25	B	38	W
13	W	26	B	39	W

In this table the first eighteen trials point to a relatively weak and unstable preference of butterfat to wheat. Trials 19 to 31, inclusive, indicate a definitely developed B preference. After trial 31 there is a complete reversal of preference from B to W.

Spectacular reversals such as the above can be explained only on the hypothesis that different bodily mechanisms regulate the demands for butterfat and for wheat.

Food Deprivation in Relation to Behavior. A good many experiments have been performed upon various aspects of behavior in relation to different degrees of food deprivation. Several illustrations are given in the forthcoming sections.

A. Food Deprivation and Activity Level. In a comprehensive series of experiments Wada studied a variety of activities in rela-

tion to gastric hunger contractions. She employed the technique, described on pp. 103-104, in which a balloon is inflated inside the stomach and the variations of air pressure due to stomach contractions are graphically recorded on a rotating drum. Her subjects trained themselves to swallow the tube and to carry on their laboratory tasks with the balloon in place; one subject even slept in the laboratory with the gastric bag *in situ.*

The graphic records of stomach contraction resembled those of Cannon and Washburn, Carlson, and other investigators who have used the method. They revealed a respiratory rhythm, a pulse rhythm, and the major changes in muscle tonus of the stomach wall which constitute the hunger contractions. As the period of food deprivation increased there was a gradual heightening of muscle tonus; then periodic contractions appeared. These contractions occurred about three to four hours after a meal, and recurred at intervals thereafter as long as the stomach was empty. When the food-deprivation period increased in duration the stomach movements grew increasingly powerful and more frequent; and sometimes they terminated in a prolonged tetanus.

An interesting point in Wada's research is the demonstration that hunger is not merely a local condition, but a general one which reveals itself in the behavior of the total organism. Along with the stomach contractions are also general restlessness and increase of the activity level.

Observations were made on the subject who slept in the laboratory with the gastric balloon in position. When the stomach was quiescent the sleeper was relaxed and quiet, but during gastric contractions he was restless and frequently shifted his posture. In other words, the restless movements which occurred during sleep were not limited to the skeletal muscles, but involved the smooth musculature of the stomach as well.

Wada also examined by other techniques the periodic changes of activity in relation to food deprivation. By means of a tambour attached to a small bed, the general activity of babies was recorded. The records revealed the fact that motor restlessness occurred periodically, and that the frequency of these activity periods increased as the feeding time approached. With adult sleepers, restless activities fell into distinct groups which had a definite periodicity (an observation in line with the well-known work of H. M. Johnson).

Wada further carried out an activity study with white rats, and found that just after the animals had been fed they became inactive or slept quietly; but as the period of food deprivation increased they became relatively more active. This suggests the experiments of Nicholls, Richter, and others upon activity level in relation to the duration of food deprivation in guinea pigs and rats.

With human subjects physical and mental tests were given at various times relative to the hunger rhythm. By means of a Smedley hand dynamometer, tests were made of the strength of grip during the presence and absence of stomach contractions. The following results present averages and probable errors for the dynamometer scores obtained under three conditions: when the pull on the dynamometer is: (1) coincident with contraction periods, (2) during quiescent periods, (3) and immediately after a meal. During stomach contractions the subjects were decidedly stronger than

	Contraction	Quiescent	After Meal
Subject C			
Av.	89.98 kg.	85.64	81.84
P.E.$_{av.}$	0.55	0.49	0.40
Subject H			
Av.	90.91 kg.	87.11	85.42
P.E.$_{av.}$	0.22	0.28	0.40

under the other two conditions. The figures shown give the combined pull of right and left hands in kilograms, the two scores being added together. The figures are averages for several series of pulls on two days for C and on three days for H.

Tests upon the rate of tapping, steadiness, and muscular co-ordination indicated that hunger contractions were associated with increase or betterment of these motor activities. The rhythms of hunger correlated highly with the ups and downs of motor efficiency.

The results of Wada's study into the relation between hunger contractions and mental alertness are very interesting. She used the fifteen forms of the Thorndike intelligence examination. In general, higher scores were made during the contraction periods than during the periods of quiescence. In continuous mental work, the

periods of fatigue and low efficiency occurred simultaneously with the intervals of quiescence in the stomach's activity.

Further, it was reported that the tendency to dream was greater during stomach-contraction periods than during quiescence; but the results are too few, and the evidence too slight, to give much weight to this observation.

All these experiments point to the same conclusion, namely, that the general activity level is higher during stomach contractions than during periods of gastric inactivity. Whether the stomach contraction is a cause of the heightened general activity, or merely one of the symptoms of the general bodily hunger state, is a perplexing question which can well be referred to the physiologist for an answer.

Regardless of interpretation, however, Wada's results agree with one's everyday experience. It is commonly known that moderate hunger favors alertness. Most teachers, for example, have discovered that an eleven o'clock class is likely to be more alert than a one o'clock group. After-dinner speakers, if wise, eat little, and in this way gain an advantage over their well-fed listeners.

B. Food Deprivation and Maze Performance. Using the learning method, Ligon investigated habit formation in the maze. He worked with three groups of rats which had been deprived of food for six, twelve, and twenty-one hours, respectively; there were twenty animals in each deprivation group.

Results for the three groups are plotted in Fig. 34, which shows the median running times for each group on twenty-five successive trials. The curves indicate that the most rapid and consistent progress in learning to run the maze was made by the rats subjected to twenty-one hours of food deprivation. For some reason or other, the six-hour group learned more rapidly than the twelve-hour one. This latter result, if significant, possibly bears some relation to the activity level, which is known to vary irregularly with the time of feeding (pp. 55-57).

A control experiment was made with animals which were placed in the maze immediately after feeding. As might be expected, these control animals learned the maze with the slowest speed of all. Considering the total experiment, it is apparent that the speed of

learning varies in general, but not uniformly, with the duration of the food-deprivation period.

In a similar rat-maze experiment Tolman, Honzik, and Robinson found that hungry rats made fewer errors than less hungry animals. There was also a qualitative difference in maze behavior which varied with the period of food deprivation.

Hungry rats entered long and short blind alleys with about equal frequency; but less hungry animals entered the long blinds more

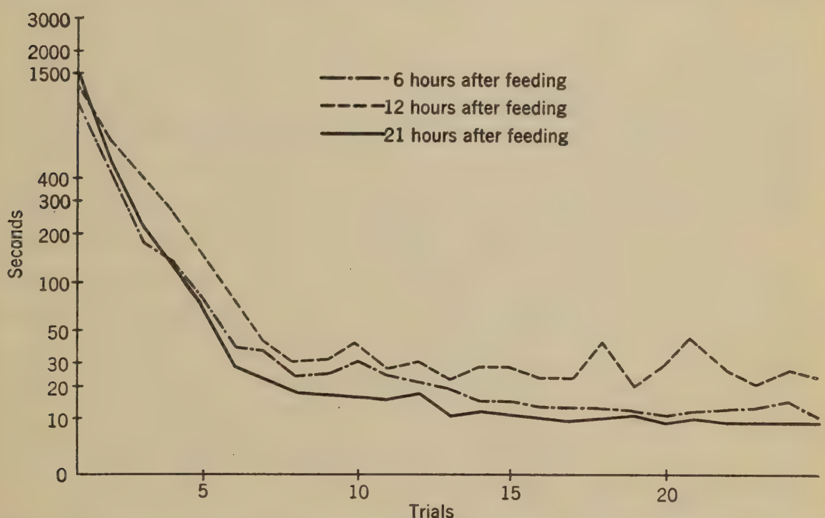

FIG. 34. MAZE LEARNING OF RATS WITH DIFFERENT PERIODS OF FOOD DEPRIVATION. (*After Ligon.*)

Ordinates give median time of running the maze for each group, in seconds plotted logarithmically; abscissae represent trials.

frequently than the short ones. When the blinds had elbows so that their ends were not visible to the rats, this difference in behavior was especially pronounced.

The explanation of this qualitative variation in behavior is not yet known. Long blinds conceivably have greater exploratory value to the animal than short ones. It may be that some relationship exists between degree of hunger and degree of dominance of exploratory behavior.

C. Food Deprivation and Pain Avoidance. In Warner's experiment upon hunger motivation with the obstruction method, a serious effort was made to control the physiological state of the

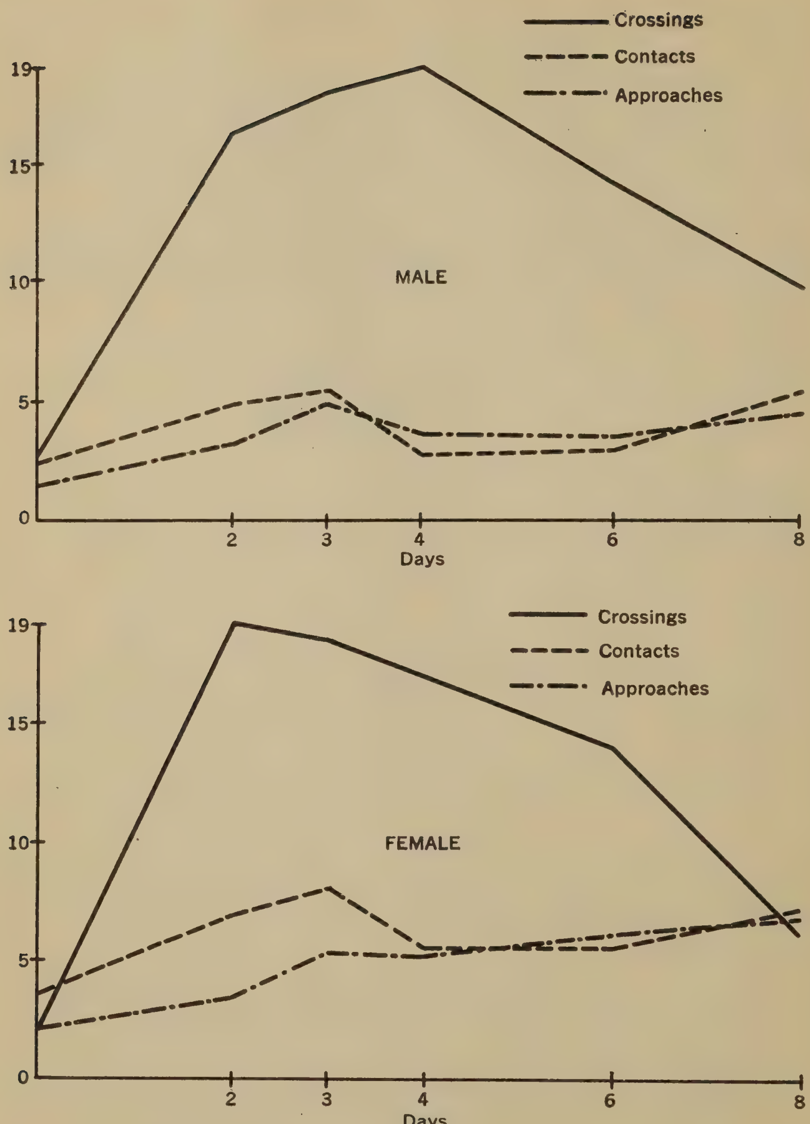

FIG. 35. DIAGRAMMATICAL REPRESENTATION OF CROSSINGS, CONTACTS, AND APPROACHES, IN THE OBSTRUCTION APPARATUS, FOR DIFFERENT PERIODS OF FOOD DEPRIVATION. (*Modification of curves from Warner.*)

The abscissae represent length of deprivation periods; ordinates the frequency of the behavior plotted. Each point on the graph gives the average score for a separate group of ten rats. Upper curve, males; lower curve, females.

animals. Groups of ten rats, all of the same sex, were deprived of food for the following periods: 0, 2, 3, 4, 6, and 8 days. For each deprivation period there was a group of ten males and one of ten females.

In the experiment, when a rat crossed the electrically charged grill, he was allowed a nibble of a food mixture in the goal compartment, and was then returned to the entrance compartment; or after one minute, in case he did not nibble, he was returned anyway. The frequency of crossings, contacts, and approaches per twenty-minute test period was determined.

Results for the different groups of rats are plotted in Fig. 35. The curve of crossings appears to reach its peak somewhere between days 2 and 4 and then to decline. For the females the peak of crossings is on the second day and for the males it is on the fourth day. This indicates that the weakening influence of a prolonged fast is shown in the female rat earlier and more severely than in the male.

The frequency of crossings, as represented in Fig. 35, at last increased and then, with longer deprivation periods, it decreased. Obviously, the *need* of the tissues for nutriment increases steadily until death by starvation; but with prolonged periods of food deprivation the animals become weakened, more fearful of the grill, and less able to withstand the painful electric shock.

As Fig. 35 shows, the number of contacts and approaches does not decline with increasing hunger, as do the grill crossings. The animals retain an orientation towards the food goal even though they are inhibited about crossing to it. Goal orientation is one thing; readiness to cross the grill is quite another. The objective need of the tissues for nourishment is still a different matter; it does not correlate with the strength of drive as exhibited in behavior.

II. Thirst

The state of the organism in thirst can be differentiated from that in hunger, from various points of view. In the first place, the most basic difference is the chemical one within the tissues, their need for water being quite distinct from the need for salts, protein, fat, etc. Again, the internal physiological processes which arouse seeking behavior are wholly different in hunger and thirst. From the behavioral point of view, the obvious difference between hunger

and thirst is that of goal objects. Further, the reactions of drinking and eating have different periodicities, as Richter has shown for the rat when surrounded by a plentiful supply of food and water. And finally, as Boring has demonstrated, the conscious experiences of hunger and thirst differ both qualitatively and in localization. These various differences between hunger and thirst show them to be wholly distinct processes, despite the fact that both lead to the taking of nutriments into the body.

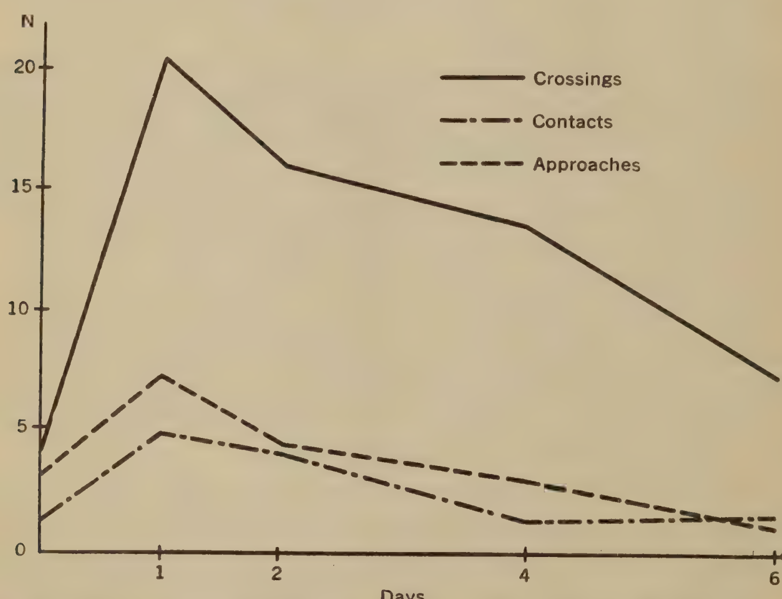

FIG. 36. FREQUENCY OF CROSSINGS, CONTACTS, AND APPROACHES TO THE GRILL, IN THE OBSTRUCTION APPARATUS WITH DIFFERENT PERIODS OF WATER DEPRIVATION. (*After Warner.*)

Degree of Thirst and the Obstruction Experiment. Warner performed a significant experiment in which he measured the intensity of the thirst drive, using the electric grill as an obstruction. In this study albino rats—fifty of each sex, 185 days old—were deprived of water, but not of food, for various periods. In order to make sure that thirst was the principal factor in operation, the animals were tested at a time when sexual drive was weak.

The rats were divided into five groups of twenty each and then tested with water-deprivation periods of 0, 1, 2, 4, and 6 days. The main results are shown graphically in Fig. 36. Of the periods

studied, water deprivation for one day resulted in the greatest frequency of crossing. With more than one day of deprivation the tendency to cross the grid diminished constantly. Incidentally, the differences in thirst behavior between male and female rats were negligible.

It is interesting to compare the results of water and food deprivation (Figs. 35 and 36). In the case both of thirst and hunger, a prolonged deprivation yielded a reduction in the number of crossings of the electric grid; there was a weakening or loss of vigor which rendered the animal less ready to receive the electric shock.

The Experience and Bodily Mechanism of Thirst. Not only water deprivation but also breathing hot dry air, eating desiccated or salted foods, prolonged speaking or singing, induce thirst. Excessive loss of water through sweating, bleeding, or great loss through the kidneys also provokes thirst.

It is interesting in the present connection to note that the subcutaneous injection of the drug atropine reduces the salivary flow, and that this causes dryness of the interior surfaces of the mouth and throat without any loss of water from the body. Thus, atropine produces the thirst experience when there is actually no general need of the tissues for water.

The thirst experience has been described by Cannon as dryness or stickiness localized at the inner surface of mouth and throat down to the root of the tongue and to the back part of the palate. This experience is definitely unpleasant. In more intense thirst the tongue cleaves to the roof of the mouth and to the teeth; a persistent lump seems present at the back of the throat.

The thirst experience depends upon a local dryness of the mouth, and this in turn results from a general water need of the tissues. Drinking or injecting water under the skin quickly removes the thirst. It is interesting, also, that the thirst experience can be removed temporarily by a superficial moistening of membranes in the mouth and throat, or by placing a wholly dry bag of ice upon them, or by cocainizing the surfaces. Persons lost on the desert with only a small amount of water learn to keep the mouth moist to alleviate their thirst.

These facts indicate that the conscious thirst experience of an individual results from local stimulations of nerve endings in the mucous

linings of the mouth and throat. A neural mechanism lies between the objective need of the tissues for water, on the one hand, and the conscious desire called thirst, on the other hand.

According to Cannon's theory, the need of the body for water is indicated immediately in the inhibition of the salivary glands. The functioning of these glands along with that of other tissues is unfavorably affected by a deficient internal water supply. They normally keep the mucous surfaces moist, and their functioning depends upon an adequate quantity of water in the blood. When the percentage of water in the blood is reduced, salivary secretion is necessarily restricted, and the mouth and pharynx become dry. This dry condition excites the receptors in the mucosa and the adjacent neurons, thus releasing the energy of the thirst drive, and also mediating conscious thirst.

III. Maternal Behavior

If two mother rats are placed in the same cage with but a single litter, one mother collects the young in her nest or corner and nurses them. The other "steals" the litter, carrying them to her own nesting place. The two mothers can be observed hustling the young back and forth from nest to nest, sometimes showing hostility towards each other, and not always, as it appears, behaving to the best advantage of the young.

The demand of the mother for possession of the litter is readily understood. The young are required for the free and normal functioning of the mammary glands; and without them a congested condition of the breasts arises. Thus there is a physiological need of the mother for the suckling of young. This need normally persists until the young are weaned, and it largely explains the urge of the mother to return to the litter.

Nissen investigated the maternal drive using the obstruction method. He placed the mother in the entrance compartment and the litter in the incentive compartment of the Columbia obstruction apparatus (p. 93), and recorded the number of crossings, contacts, and approaches just as had been done with other drives.

In summing up the results of this work he wrote:

"The animals were divided into five groups corresponding to as

many sets of conditions under which the tests were conducted. The results indicate that the intensity of the maternal drive

"(*a*) is slightly greater than that of the hunger and thirst drives at their maximum (80, 72);*

"(*b*) is greater than that of the sex drive at its maximum (99.6);*

"(*c*) decreases as the age of the animals increases, when litters are being dropped with normal frequency (94);*

"(*d*) decreases considerably as the age of the litter increases (98);*

"(*e*) decreases if the mother is separated from her litter for about four hours immediately preceding the test (90).*"

In comparing the maximum strength of the different drives Warden concluded that the maternal drive tops the list; and by "maternal drive" he meant the readiness of the rat to cross the electric grill to reach the young. There are, however, other patterns of maternal behavior closely associated with returning to the litter and nursing. One of these is the strong urge of the mother to retrieve the young when they have wandered away. Not only does she bring back the young of her own litter, but also those of other litters, and even lifeless objects, such as small bags of sand, or blocks of wood. She will carry the young of another mother to her nest when they are as much as four days older or younger than her own litter, but there is some discrimination against young eight days older.

This impulse to retrieve the young persists normally for ten to twenty-five days after parturition. It continues during the lactation period, and sometime between the twelfth and twentieth days following parturition begins to show a marked decline. Harlow has studied this behavior experimentally. Three of his six curves are reproduced in Fig. 37.

Another pattern of behavior which is related to the birth and care of the young is nest-building. Sturman-Huble and Stone have demonstrated that nest-building is very pronounced in the parturient rat; it is readily elicited for seventeen to twenty days after parturition, at which time the young begin to leave the nest.

The nest is an amorphous heap which takes shape only from the weight and movements of the mother and young. In building a nest,

* These figures represent the statistical reliability of the indications stated, in terms of the chances in 100 of a true difference.

however, the rat shows preferences as to location, kind and condition of material, etc.

In one experiment Sturman-Huble put a parturient female and her litter in an apparatus consisting of two end-cages connected by a long runway. See Fig. 38. After the female had constructed a nest in one end-cage a current of air was turned on the nest and

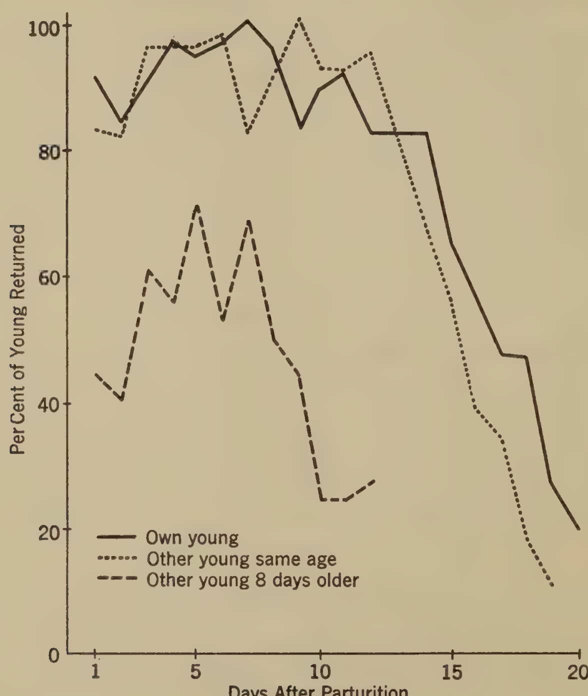

FIG. 37. RETURN OF YOUNG TO THE NEST BY MOTHER RAT. (*After Harlow.*)
Comparison of number of own young, other young of the same age, and young eight days older.

young. Generally the mother moved the nest and litter to a place outside of the current of air.

Nest-building is of interest because this pattern of behavior is not exclusively related to the care of the young. Kinder has shown that nest-building is associated with thermal regulation in the rat; it is called out by low temperatures even in rats without young.

What constitutes maternal behavior in the rat? Is it nursing of young? Return to the litter? Retrieving of the young and similar

objects? Nest-building? Or all of these together plus other activities not here considered?

Regardless of the answer, one point is clear: the behavior of the mother in caring for the young is complex, and it can be analyzed into a number of component activities. How far these components have a common physiological basis is a problem in need of further investigation.

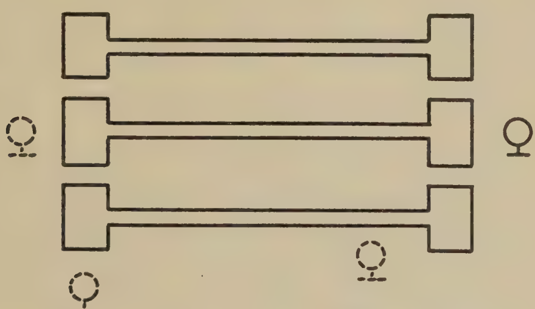

FIG. 38. APPARATUS USED FOR STUDY OF NESTING IN THE MOTHER RAT. (*After Sturman-Huble and Stone.*)

The equipment consists of two end-cages connected by a long runway. Different positions of the electric fan, used to force an air current over the nest, are shown.

IV. SEXUAL DRIVE

To a considerable extent the basic sexual motivation of man and animals is similar, but the psychological elaborations in the sphere of human sexual behavior are so complicated that they warrant separate consideration. The student should be cautioned against drawing conclusions about human sexual motivation from the experiments upon animals which are described below.

The Basis of Sexual Behavior in the Rat. In laboratory animals it has been demonstrated that sexual behavior depends for its appearance upon chemical agents furnished by the reproductive glands, aided by hormones from certain other glands of internal secretion. The male rat, for example, is not excited by the receptive female prior to puberty; but as the germ cells begin to mature and the interstitial tissue increases, the internal secretion of the gonads is augmented, and the rat becomes sensitized to the patterns of stimulation afforded by the female in heat. Stone has shown that

the fully developed male rat copulates with a receptive female when opportunity is given, without any necessity of learning the copulatory act from observing it in other animals. In other words, the fully integrated copulatory pattern appears when the reproductive organs are mature and activated, and the adequate environmental stimulation is present.

The surgical removal of the reproductive glands before puberty prevents the appearance of sexual behavior. If performed after puberty, the operation causes sexual behavior to disintegrate and disappear. The grafting of testes or the injection of macerated gland tissue re-establishes sexual activity, permanently or temporarily, in the castrated rat.

It has been shown also that the grafting of ovaries in the castrated male induces typical feminine behavior. Transplantation experiments have demonstrated that feminine behavior depends upon an autacoid from the ovaries, and that masculine behavior depends upon an autacoid from the testes. The question at once arises, "How do these chemical agents act to induce masculine or feminine behavior?"

In discussing this question Lashley has noted three possibilities. The chemical agent might: (1) increase the general excitability of the animal by changing its metabolism, or (2) increase the tonus of structures controlled by the vegetative nervous system, or (3) act directly upon the central nervous system. Of these possibilities Lashley favors the last. The direct action of the autacoid upon the central nervous system is assumed to affect reflex centers in such a way that the sexual reactions are rendered excitable. The autacoid is not a general activating agent, but a specific one.

The sexual reactions of both the male and the female rat are specific responses to definite patterns of stimulation. The mature male animal is excited sexually by almost any small object which moves away in a series of quick jerks. This type of movement is characteristic of the female in oestrus; she runs forward and then stops suddenly, runs again and stops so that her progression is jerky instead of smooth. Simulation of this type of movement with some lifeless object is enough to excite the sexually mature male. His response to this pattern of stimulation is increase of general activity, pursuit

of the stimulating object, seizing of the object with the forelegs, and making of copulatory movements. Although the pattern is complex, it can nevertheless be reduced to a series of stimulus-response relationships similar to those of a simple reflex.

The stimulus patterns which arouse masculine behavior in the rat, however, are not limited to any single sense department. Stone has shown that sexual responses may be evoked through vision, audition, smell, taste, or touch. The pattern which arouses male sexual responses may even be given wholly through the kinesthetic sense.

According to the point of view of Lashley and Stone, the motivation of sexual behavior is a definite physiological problem. In general, explanation is given in terms of: (1) bodily structure; (2) the maturation of structure, especially the organs of reproduction; (3) the stimulus-response relationship; (4) the action of internal chemical sensitizers; (5) environmental stimulations from the mate or other object. No *libido* or psychic force is needed to explain the sexual behavior of the rat.

Sexual Drive in the Rat as Revealed by the Obstruction Method. In a discussion of sexual activity the facts necessitate a separate treatment of male and female behavior.

1. The activity level of the mature female rat is rhythmical, as illustrated in Fig. 12 (p. 55). There are periods of high activity followed by periods of relatively low activity; and the total cycle has a periodicity of about 4.6 days. Although the rotating drum clearly reveals this activity rhythm, it fails to show a point of great importance. During the peak of activity the animal is in heat, or oestrus, exhibiting the specific patterns of behavior, and possessing the characteristic odor, which arouse copulatory behavior in the male. In the periods of low activity, on the contrary, the female is indifferent to the sexual advances of the male, and will even fight him off.

The variations in female sexual drive have been studied by Warner, using the obstruction method with a vigorous male as the incentive. Figure 39 gives the number of grill crossings, contacts, and approaches for a group of female rats in successive stages of the oestrous cycle. The curve presents one complete cycle and shows the waxing and waning of the sexual drive. The maximal drive is

associated with the presence of cornified cells in the secretions from the reproductive tract.*

2. In the male no corresponding rhythm has been discovered. Consequently it is safe to assume that the male sexual drive is much more uniform than that of the female.

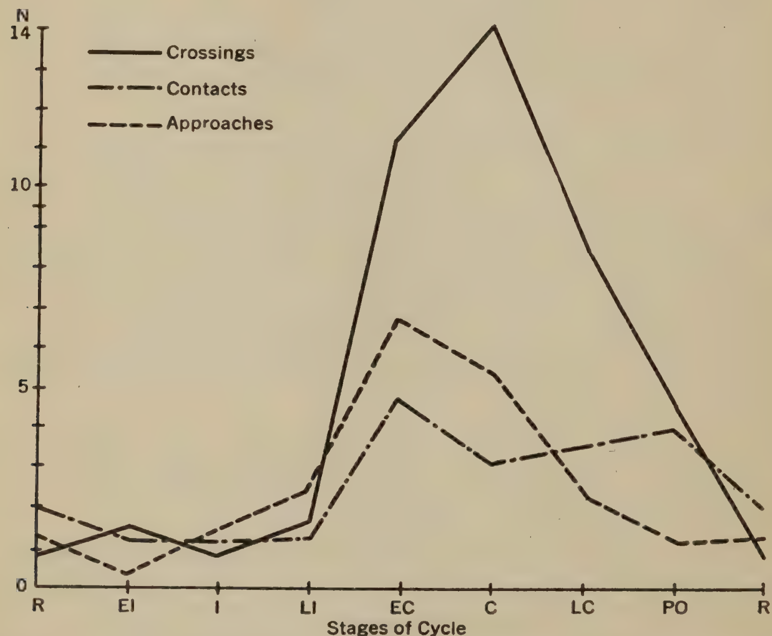

FIG. 39. VARIATIONS IN SEXUAL DRIVE FOR DIFFERENT STAGES IN THE OESTRUS CYCLE OF THE WHITE RAT. (*After Warner.*)

The points along the base line mark successive changes in the histological character of the vaginal secretions. These successive changes, symbolized by letter, are: recuperative, early inactive, inactive, late inactive, early cornified, cornified, late cornified, post ovulative, recuperative.

The sexual drive of the male rat is weakest immediately after a prolonged period of copulation with a receptive female; this brings about a condition approaching satiation. Recovery from this low point is rapid during the first twelve hours, and after twenty-four hours the drive reaches its maximum.

Variations in the strength of the male sexual drive, as revealed

* Cornified cells are flattened, non-nucleated cells such as those which are continually scaling off from the surface of the body.

by the obstruction method, are shown in Fig. 40. Receptive females were used as incentives in the goal compartment. The curve, as noted above, shows that the maximum drive is present after twenty-four hours of deprivation.

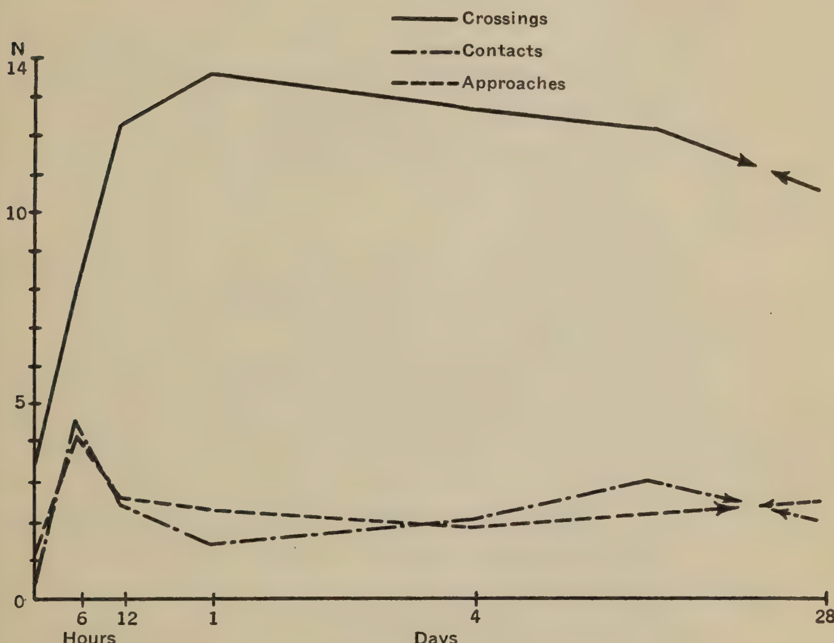

Fig. 40. Variations in Strength of Male Sexual Drive in the White Rat. (*After Warner.*)

Along the base line are plotted the intervals of sexual deprivation following a copulatory period. These intervals are 0, 6, and 12 hours; 1, 4, 7, and 28 days.

Sexual Behavior in Monkeys and Baboons. Hamilton made a series of careful observations upon the sexual behavior of monkeys and baboons. He classified the behavioral tendencies as follows:

1. Tendencies to seek sexual satisfaction.
   - A. Male tendencies:
     - (*a*) To engage in typical sexual intercourse with females.
     - (*b*) To increase sexual excitement by preliminary examination of the female's genitalia, or by chasing or biting the female.
     - (*c*) To use a younger or weaker male as a female.

(*d*) To play the rôle of female to a copulating male.
(*e*) To attempt copulation with non-primates and humans.
(*f*) To masturbate (probably developed only under abnormal conditions).

B. Female tendencies:
(*a*) To engage in typical sexual intercourse with males.
(*b*) To play the rôle of male to younger or weaker female.
(*c*) To play the rôle of female to friendly female.
(*d*) To solicit copulation with non-primates.

2. Tendencies to assume the female sexual position as a defensive measure.

A. Male tendencies:
(*a*) To assume the female sexual position when attacked by a more powerful fellow of either sex.

B. Female tendencies:
(*a*) To assume the female sexual position when attacked by a more powerful fellow of either sex.

3. Tendencies to seek to lure an enemy to attack by assuming the female sexual position.

A. Male tendencies:
(*a*) To lure a male enemy to attack by assuming the female sexual position.

B. Female tendencies:
(*a*) To lure a female enemy to attack by assuming the female sexual position.

This list of tendencies is a generalization based upon the detailed facts of observation of the sexual behavior of monkeys and baboons. Hamilton made no attempt to state how far the tendencies were instinctive and how far acquired. It is clear, of course, that a statement of tendency *explains* nothing; rather it *describes* some repeatedly observed characteristic of behavior.

V. Other Fundamental Drives

The foregoing discussion of hunger, thirst, maternal, and sexual drives illustrates the nature of the primary, or fundamental, urges in behavior. A complete list of the fundamental drives would naturally differ from species to species. In mammalia, apart from the above examples, there are at least the following additional drives;

General activity drives.
(*a*) The urge for exercise after prolonged rest.
(*b*) The appetite for repose in a fatigued condition.
(*c*) The demand for sleep after sleep deprivation.
Aversion to injury (pain-avoidance).
Temperature regulation drives.
(*a*) Adaptation to high temperatures.
(*b*) Adaptation to low temperatures.
Respiratory drive: the demand for air during suffocation.
Drives evoked by "dangers" (emergency reaction).
(*a*) Fear—flight.
(*b*) Anger—attack.
(*c*) General bodily excitement.

Concluding Statement. The present chapter is a survey of the principal methods used in the study of animal motivation, and typical results obtained. The discussions of hunger, thirst, maternal behavior, sexual drive, and other fundamental drives indicate what has been already accomplished in the exact study of animal motivation and suggest possibilities for future research in this field of psychology. Motivational principles based upon these and similar experiments will be considered in the next chapter.

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CHAPTER IV

DRIVE AND PURPOSE

"Purposive action is the most fundamental category of psychology; just as the motion of a material particle . . . has long been the fundamental category of physical science. Behavior is always purposive action, or a train or sequence of purposive actions."

—William McDougall

A detailed consideration of the primary drives brings to light the involvement of specific tissues as the source of persistently motivated behavior. In each of the basic drives mentioned in the preceding chapter the bodily mechanisms are physiologically distinct.

THE BODILY BASIS OF DRIVES

Physiological Differentiation of the Primary Drives. Although the original conception of drives, and their classification, are based upon observations of behavior, not until they come to be differentiated in terms of inner bodily mechanisms will law and order be discovered in this rapidly developing field of psychology. Hunger and thirst can be thus distinguished, in terms of the tissues. The facts are so convincing that there is no ground for quibbling over the validity of the distinction. It is even possible that the demand for food may be found to involve specific bodily mechanisms for different kinds of foods; but until they have been demonstrated physiologically, it is well to refrain from speaking of a "fat drive," "a carbohydrate drive," "a salt drive," and so on.

Again, there are good grounds for distinguishing male from female sexual drives on the basis of bodily mechanisms. Not only are the reproductive organs structurally different in the sexes, but also the chemical sensitizers, or hormones, present in the internal secretions of the gonads induce characteristic forms of masculine and of feminine behavior. Similarly, maternal behavior, viewed from the standpoint of bodily mechanisms, depends upon a persist-

ing physiological state in the lactating mother, which state as a whole can readily be distinguished from those associated with the other drives.

Although the primary drives have their complex origins in the tissues, one can by no means argue conversely that an individual tissue or organ is the source of a specific drive. The circulatory system, for example, although it plays an important rôle in behavior, being especially prominent in emotional reactions, cannot be said to have any unitary and specific "circulatory drive" depending upon it alone. Similarly, there is no "stomach drive." The regulating of hunger, as we have seen, involves stomach contractions, but it also involves processes in various other parts of the body, such as metabolic changes in the cells, chemical changes in the blood, neural excitations.

Thus, differentiation among the fundamental drives can be made on a frankly physiological basis when we take into account the whole complex of tissue conditions. Where physiological differentiation is impossible for any reason, the conservative policy is to assume, for the present, that the drives in question are not primary. In conclusion, it is well to repeat that the conception of "drive" is essentially behavioral, and that the physiological interpretations, important as they are for differentiation and classification of drives, must always start from the facts of behavior.

Bodily Mechanisms of the Basic Drives. All fundamental drives have certain common characteristics, namely: (*a*) a persistent condition in the tissues; which gives rise to (*b*) a sustained stimulation of afferent nerves; from the latter (*c*) a release of energy in nerves, muscles, and other tissues, which raises the activity level; and (*d*) in developed organisms, goal-directed behavior; with (*e*) a goal object or a consummatory reaction which is capable of removing the persistent tissue condition mentioned in (*a*), thus restoring homeostasis.*

Some drives depend upon a mechanical pressure on receptors located in the walls of hollow viscera, or of ducts. In addition to food hunger, and the appetite for suckling in the lactating mother, further examples of this are found in the urges for defecation, and

* For a discussion of homeostasis see pp. 81-83.

micturition, and to some extent in the male sexual drive. In such cases the persistent mechanical stimulation from distension of the respective organs (or from contraction in the case of the stomach) brings an urge for discharge or other relief.

Certain other drives have a somewhat different basis. They depend directly upon the physical or chemical state of the tissues. In thirst, for example, dehydration of the tissues and especially of the mucous lining of mouth and throat gives rise to the persistent stimulation which releases the energy manifest in the thirst drive. Again, in the case of the pain-avoidance drive, conditions which threaten the integrity of the tissues, such as drops of acid on the skin, painfully high or low temperatures, cuts, electric shocks, give a direct and often a persistent excitation which leads whenever possible to the avoidance of pain and injury.

Still other drives depend upon some internal chemical factor, known or assumed. Examples of such drives are the demand of the organism for oxygen, the urge for quiescence after exercise, the urge for exercise after rest, the demand for sleep, the female sex urge to some extent, and probably certain cravings or aversions for specific food substances. The chemical agents in the blood stream are commonly assumed to excite the nerve centers directly. In muscular fatigue, for example, it is believed that carbon dioxide and other fatigue products in the blood excite the respiratory center in the medulla, or at least render the neurons of that center more excitable, in this way quickening respiration and the re-oxygenation of the blood.

The glands of internal secretion continuously pour out into the blood stream chemical substances containing their characteristic hormones, or autacoids, and these may be the source of drives. How the hormones act to establish a specific drive is not known in detail. Holt, in discussing chemical regulation, assumes that the chemical agents stimulate certain unknown receptors. He writes:

> In short, it seems to me that the safe and sober view here is that the deficit stimuli (chemical) probably exist, that they may (or may not) exist in the blood, that they stimulate specifically different receptor organs, and that at present nobody has the faintest idea what or where these receptor organs are.

It is to be hoped that further study of the chemical bases of behavior (which study may be called the science of "psychochemistry") will greatly increase our knowledge of the bodily mechanisms of the primary drives.

THE ENVIRONMENTAL CONTROL OF BEHAVIOR

The separation of organism and environment is convenient and practically useful. The environment is the source of food, air, water, heat energy; it is also the source of injury, death, poison, pain. In a very real sense, it is the stage upon which an organism acts, and the acting cannot be described without reference both to the organism and to the environment.

In respect to all behavior, the energy which moves an organism is stored within the tissues and released by stimulation. With the primary drives, some persisting physiological state is the source of the behavioral urge; but this is only part of the picture. Just as persisting internal tissue conditions incite the organism until physiological quiescence is restored, so continuing environmental stimulations arouse activity until some final adjustment is made to them.

These continuing environmental conditions will be illustrated below. As a matter of fact, the environmental and the organic factors in motivated behavior are constantly interrelated, and the first example given below—the emergency reaction—illustrates well their interdependence.

The Emergency Reaction. When a cat is pursued by a barking dog the first reaction is flight and escape, but if the cat is cornered, the pattern changes to that of attack. The difference between flight and attack, so far as is known, does not lie in the accompanying endocrine secretions and the visceral processes associated with the two reactions, but rather in the dynamic relationship between the organism and its environmental situation. Flight is an avoidance, a negative reaction to a threatening or dangerous situation. Attack is an approach, a positive reaction to the same general type of situation.

If the cat is lucky enough to escape from her tormentor by climbing a tree, a state of general excitement is exhibited for some time in the animal's behavior. The excitement lacks a specific goal orien-

tation, but the cat, nevertheless, is all keyed up to fight or to run should the need arise.

The internal bodily reactions to the source of a biological danger have been called by Cannon the "emergency emotions." Considered as a group they involve a pattern of bodily changes which prepare the organism for vigorous struggle and prolonged activity. The increased secreting of the adrenal glands, the more rapid liberation of sugar from the liver, the acceleration of heart action and of respiration, and other bodily changes, all prepare and integrate the organism for marked energy expenditure, as Cannon has shown.

On a tissue basis the total group of emergency reactions can be differentiated clearly from those involved in hunger, thirst, sex, and the other basic drives. The interesting fact remains that, despite repeated experimentation, neither Cannon nor his collaborators have found any physiological difference between the glandular and visceral processes associated with fear (flight) and rage (attack). From the physiological standpoint, therefore, fear, rage, and the general excitement which is a hangover from them are quite alike. Yet everyone, from the psychologist to the child on the street, differentiates fear from anger; the common experience of all testifies to the genuineness of this distinction.

Upon what basis, then, can the emergency reactions be differentiated? As observed above, the distinction between flight and attack lies not in the intraorganic processes, but rather in the dynamic relationship between organism and environmental situation. Also the emotionalized attitudes of fear and anger can best be described in terms of a dynamic relationship between an individual and his world. When we are afraid we fear *something*; when we are angry we are angered at *something*.* In other words, the distinction in question is behavioral rather than physiological.

Because of this the emergency reactions are of especial interest. To summarize, the total group can be differentiated from other basic drives on a bodily basis; but, within the group, distinctions can be made only on a behavioral basis, or, in other words, by

* There are rare instances of objectless fear or anxiety. The physiological basis of fear is then present without an adequate environmental support. An interesting example is the objectless fear sometimes felt after the experimental injection of adrenalin.

reference to the organism's back-kick upon some persisting environmental condition.

The Reactions to Novelty. If a rat is placed in a novel situation, provided fear is not evoked, the typical behavior is exploratory. A hungry rat explores his environment before eating; sexually vigorous animals confronted with a mate in a new environment explore before copulating. Exploratory behavior is highly characteristic of the rat, and this makes him an especially satisfactory subject for such pieces of apparatus as the maze. A maze especially designed to incite exploration, copied from Dashiell's model and enlarged, is shown in Plate IV. When a rat is placed at the opening of such

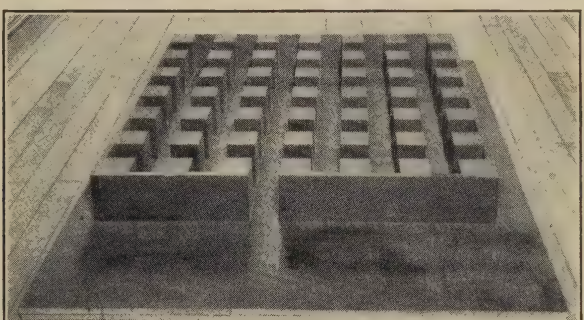


PLATE IV. ENLARGED DASHIELL MAZE FOR ELICITING EXPLORATORY BEHAVIOR IN THE RAT. (*University of Illinois Psychological Laboratory, courtesy of Dr. E. E. Anderson.*)

a labyrinth he starts to investigate the novel environment; exploration continues until the maze has been thoroughly examined. Unusual objects placed here and there, such as corks, sawdust, wire-mesh partitions, etc., add to the "exploratory value" of the maze.

Nissen has shown that rats will cross an electric grid and take a painful shock to reach a novel compartment which provides opportunity to explore. The greater the "exploratory value" of the incentive compartment the more readily do the rats cross the grid. Although his results are of low statistical reliability, Nissen concludes that one is justified in speaking of an exploratory drive just as one now does of sex, hunger, and thirst drives.

During exploration practically all the sensory-motor equipment of the rat is called into play in sniffing, looking, listening, biting, and the other specific reactions which make up exploratory be-

havior. The essential condition for exploration is a novel environment; the "curiosity" reactions disappear when the animal becomes thoroughly acquainted with his new surroundings.

Exploration is pronounced in the behavior of hunting dogs, cats, and the wild animals which of necessity find their way about in the jungle. It is also marked in man. Not only the relatively small group of professional explorers, but likewise the man in the street, display this behavior. Who has not experienced an inner urge to explore a new house which is going up in the neighborhood, or a thickly wooded country with many winding pathways and streams which fairly beg the newcomer to explore and discover? The young child when presented with a new toy manipulates it in various ways: scrutinizing it, pounding, tasting and biting it, throwing it away, and so forth. When a little older he asks endless questions about the circumambient world; his elders say he is at the "curiosity" age. This same questioning attitude in the adult has led to important practical discoveries and inventions and to scientific investigation that has enormously increased human knowledge.

The biological importance of exploration is obvious. It yields acquaintance with one's surroundings, revealing possible dangers, places and paths of safety, sources of food, enemies, members of one's own species, and so on. In a Darwinian sense, other things being equal, the animal with the greatest penchant for exploration has the best chance of survival.

The exploratory drive is an excellent example of behavior which depends upon persisting environmental conditions (novelty) rather than upon a physiological state. It continues until the environment becomes familiar and known rather than strange and uncertain.

Playful Behavior. The playful behavior of animals and man has been universally observed and much studied; yet no one claims that there is a special play-gland, or any localized tissue condition which initiates all playful activity.

It is quite likely, however, that playful behavior depends partly upon a metabolic state of the organism which is conducive to a relatively high activity level; to this extent playing may be assumed to have an organic basis. Certainly an extremely sick animal or child does not play with vigor; exuberance of energy is sometimes regarded as the essential condition of play.

Playful behavior, as such, has no characteristic pattern of reaction; but it is made up of many. For example, the kitten at play pursues, pounces, growls, bites lightly; seemingly her whole repertoire of reactions is exhibited. Even fragments of sexual behavior appear in play.

Inasmuch as sexual play is observed to be carried on without copulation, the suggestion has been made that the sexual behavior is really made up of two components: contrectation (*i.e.,* sexual play) and copulation. This distinction is behavioral rather than physiological. One can argue that contrectation is a weakly aroused, possibly an inhibited, sexual drive; or one can claim that it is a true form of play which merely utilizes the sexual action systems. In the rat, for example, nosing, biting, chasing, mounting, and other reactions which are normally part of copulation, appear in play. For a scientifically correct analysis of sexual play and its motivation further observations in the laboratory are needed.

Although playful behavior depends in part upon an organic and mental state, the specific reactions called out in play are determined largely by the particular environment. The environment dominates play more in the animal than in the child, more in the child than in the adult, more in the untrained adult than in the highly educated individual. Consider, for example, the environmental control of behavior in an active, healthy dog, described by Holt as follows:

> A house dog let out in the morning usually romps away to his favourite post or tree, smells carefully of all sides of it, micturates on it, and then looks about; he spies the tree where the old cat is apt to sit waiting for robins, so he bounds off thither; having driven the cat up the tree, he takes an olfactory survey of the spot, and then observes that the cross cow is tethered in the field half way up the hill, so he dashes on to give her a disturbed ten minutes; when tired of this he stops to look about, and his eyes alight on the swimming-hole down at the foot of the hill, so away he bounds again and does not stop until he is in the water; emerging from this he shakes himself, rolls on the grass, and dashes off on some further enterprise. Clearly the pursuance of one quest brings the animal into a situation where some new stimulus incites him to a new activity. This is diversion.

In other words, the sequence of reactions in the life of a dog is

determined in large part by the sequence of environmental situations. His behavior changes his environment; the new environment in turn leads him to a new form of behavior.

Thus in play and in all free exuberant activity there is environmental regulation first and last, but, as we have noted, there is also a predisposing organic and mental state.

Social Behavior. Among the animal species best known to the average man socialization is frequently present. Birds migrate in flocks; wolves hunt in packs; monkeys travel through the woods in groups; fish swim in schools; boys play in gangs; ants, bees, and other insects have highly evolved social organizations. Human society, indeed, is only one example of a widespread biological phenomenon; but it is the outstanding example, so far as complexity of organization and social tradition are concerned.

The rat has served the psychologist well* in many fields, and it too has its contribution to offer in the sphere of social behavior. Ligon and others have studied social motivation in the rat. In one experiment male rats learned to run the maze when the only incentive was another male placed in the goal-box. The rats were reared in pairs, a pair being constantly together in the same living-cage, except during periods of experimentation. When one member of the pair ran the maze the other was placed in the goal-box as an incentive, no other reward being offered. A second group of animals ran the maze under similar conditions, except that each rat had been reared separately in an individual cage. The subject, after running the maze, found another male rat in the reward box, and was allowed to remain with him for half an hour. As a control, a third group of rats (which had been living in individual cages), ran the maze to an empty goal-box.

The group differences in the learning scores were small and statistically unreliable, yet the general trend of results was in accord with expectation. The group of rats running to the empty cage made the poorest scores; those running to the cage-companion made the best scores. The motivational sequence was: return-to-cage-companion $>$ finding-strange-rat $>$ empty-goal-box.

In man, social behavior is far more complicated and highly developed than with animals. Communication by means of speech,

* So well, in fact, that Professor Tolman saw fit to dedicate his book, *Purposive Behavior in Animals and Men,* to *Mus norvegicus albinus.*

gesture, and facial expression; social stimulation from other persons through imitation, suggestion, praise or reproof, rivalry, laughter and weeping, expressions of sympathy; response to friends and acquaintances, to strangers, to the crowd, the audience, and other social groups; adjustment to persons in the family, in business, in clubs, lodges, churches, social gatherings: these and similar processes, the study of which belongs to the important and rapidly growing field of social psychology, indicate the complexity of human social motivation.

In the present context the point to be made is a fairly simple one: social behavior can be distinguished from non-social in terms of the environment which excites the organism. The point has been stated clearly by Allport, who writes:

> Behavior in general may be regarded as the interplay of stimulation and reaction between the individual and his environment. Social behavior comprises the stimulations and reactions arising between an individual and the *social* portion of his environment; that is, between the individual and his fellows. Examples of such behavior would be the reactions to language, gestures, and other movements of our fellow men, in contrast with our reactions toward non-social objects, such as plants, minerals, tools, and inclement weather. The significance of social behavior is exactly the same as that of non-social, namely, the correction of the individual's biological maladjustment to his environment.

Social psychology is thus defined by Allport in terms of the reactions which an individual makes to his social environment. Any attempt to define this field of our science by reference to the sense organs, nervous system, glands, or other bodily structures would miss the point, because all parts of the organism are (or may be) involved, both in social and in non-social reactions. Hence, a definition of social psychology on a bodily basis alone, without reference to the social environment, is out of the question. Social motivation, with all its complexities, must therefore be investigated mainly from the standpoint of an individual's *social* environment.

THE COMPLEXITY AND INTERRELATIONSHIP OF MOTIVATING CONDITIONS

We have seen the importance of tissue conditions and of environmental factors in human and animal behavior. It remains to be

pointed out that these two great groups of determining factors are most complexly and intimately related. Environmental changes directly affect bodily processes, just as one change within the body broadcasts its influence to other parts.

It is best to consider any bit of behavior as dependent upon the total organic and environmental state. Internal bodily conditions are so delicately balanced and interdependent that it is almost impossible to find wholly unrelated variables. If a single organic factor, such as the percentage of adrenin in the blood, be experimentally varied, many physiological and behavioral manifestations result. Any attempt to isolate and to vary a single factor is likely to bring about other modifications at the same time.

Examples of the Interdependence of Motivating Conditions. So far as the fundamental drives are concerned a few of the interrelationships are noted below:

1. *Thirst and food intake.* In his experiment upon thirst, Warner found that the food intake of rats fell off decidedly during long periods of water deprivation, even though the animals had plenty of food in the cage. Deprivation of water thus brought about a reduction of the hunger drive and a general metabolic disturbance. Forced feeding, even if it were practicable, would not remove this difficulty; it would probably only disturb the internal conditions of the animal.

2. *Hunger and sexual drive.* According to Moss, the strength of the sexual drive is weakened when rats are deprived of food. Other investigators, working with both man and animals, have found that sexual drive is inhibited or abolished by prolonged hunger and also by a strange environment, by endocrine disorders, and by various other conditions.

In a nutrition experiment described by Miles twenty-four young men lived for a time under a régime of restricted diet with an energy content of approximately two-thirds to one-half of their supposed caloric requirement. When the body weight had decreased approximately 12 per cent, the food was increased.

The young men while living at a lowered nutritional level were given personal interviews. All of them reported a lowering of sex drive during the restricted diet. There was less sex interest, less desire to associate with the opposite sex, less appeal of dances and

social affairs, less sex appeal in shows, pictures, and stories. No man testified to a heightened sex desire concurrent with the lowered nutritional level.

3. *Hunger and exploration.* Dashiell placed rats in an exploratory maze (p. 141) and scored exploratory behavior by counting the number of units of the maze entered in the time allowed. If a rat put his foot into one of the units, that was checked as an entrance. Scoring in this way, he found that hungry rats explored to an appreciably greater extent than satiated ones.

4. *Maternal drive and reaction to novelty.* In an experiment upon maternal drive in rats, Nissen used a special maternity cage in which the litter had been born, attaching this cage directly to the obstruction apparatus. Commenting upon the plan Warden wrote:

> It may be argued that, in such a case, we are testing the maternal drive plus the tendency to return to the home nest. But the truth seems to be that when the normal conditions of maternity are disturbed by transferring the litter to an unfamiliar apparatus, the tendency to explore the novel surroundings of the litter interferes with the maternal drive. Then, too, many animals ignore young that have been moved about—this is true of many species of birds such as the quail.

5. *Maternal drive and food intake.* After a litter is born there is generally a marked increase in the amount of food eaten by the mother rat. According to Wang, the food intake may even reach three times the normal amount. This means that the physiological state underlying maternal behavior influences the conditions which regulate food ingestion.

6. *Oestrous cycle and food intake.* Quite apart from maternity, there is a definite relationship between the quantity of food eaten and the oestrous cycle. There are, in the mature female, regular fluctuations of food intake which vary inversely with those of the oestrous cycle. At or near the peak of oestrus, when activity is highest, the food intake reaches its lowest level. Moreover, these fluctuations in food intake are absent when oestrus is temporarily suspended during gestation and lactation; they are absent from the food curves of male rats and immature females. The facts indicate, therefore, that organic conditions which regulate oestrus and those which regulate food intake are interrelated in some way.

7. *Nest-building and oestrous cycle.* Nest-building activity also fluctuates with the oestrous cycle. Variations in the nest-building of rats have been studied quantitatively by presenting the animals with strips of paper and at a later time counting the number of units heaped together to form a nest. The nest is in no sense a work of art, but rather an amorphous pile which takes shape only through its repeated use by the animals. Two methods of presenting materials have been employed by Richter and Kinder, respectively. The first consisted of distributing the paper strips evenly over the floor of the cage; the second, of hanging them over the horizontal rim of the cage wall. With both methods the number of strips utilized was the criterion of nest-building activity.

These two experimenters obtained concordant results. Kinder concluded that nest-building of the adult female rat shows cyclic variations which are synchronous with, but inversely related to, the oestrous cycle. The maximum of nest-building occurs during the dioestrous interval, and the minimum at the peak of oestrus. Thus the nest-building cycle is inversely related to that of running activity (pp. 54-55).

8. *Nest-building and temperature.* The amount of nest-building activity also varies with the environmental temperature, being increased at low temperatures, except that in extreme cold this is not the case. Conversely, at high temperatures the amount of nest-building is decreased.

9. *Activity level and temperature.* We have previously seen that the level of general activity varies inversely with temperature (pp. 60-63).

The nine illustrations listed above constitute a fair sampling of the experimental facts which demonstrate interdependence and complexity of relationship among motivating conditions. Any attempt to isolate a single drive for experimental purposes brings to light many complicating conditions. Hence we repeat what was stated early in this section that it is wise, at least for the present, to consider behavior as dependent upon the total organic and environmental state rather than upon single isolated factors, and to approach the problem of drive from this angle.

The Relative Dominance and Hierarchy of Drives. Attempts to determine which of two drives, such as sex and hunger,

is the stronger have been made by Moss, Simmons, Tsai, Warner, and others. The most thoroughgoing comparison is that of Warden, based upon the work of his collaborators, who measured the maximal strength of different drives in the rat. Using the experimentally determined maxima as a basis for comparison, Warden ranked the drives in the following order:

First: maternal.
Second: thirst.
Third: hunger.
Fourth: sex.
Fifth: exploratory.

Warden's ranking has been criticized by Leuba on the ground that the results depend upon the arbitrary use of a twenty-minute period with the obstruction apparatus. "If we take only the number of crossings during the first five minutes, the thirst drive is undoubtedly stronger; if the experimental period were to last thirty or forty minutes, however, it looks as though the hunger drive (after three days of food deprivation) would be decidedly the stronger, in terms of average number of crossings."

Warden and his collaborators, who have stressed the importance of controlling conditions in research with animals, and who have set such an excellent example of this in their own work, would doubtless agree that with a different period of observation another hierarchy of drives might appear. Under one set of conditions drive *A* is prepotent to *B*, but under other circumstances *B* dominates *A*.

Changes in the relative dominance of two drives are sometimes clearly observable in behavior. Sexual behavior may disappear during fear or hunger. Under other circumstances the fear or the hunger motivation may utilize sexual activities to attain some goal. Kempf and Hamilton both noted that monkeys sometimes offer sexual favors to obtain food or protection from the assault of other monkeys. When, for example, an enemy is present, a monkey (of the same or opposite sex) has been seen to assume a sexually inviting posture, thus distracting the attacker and by this means making an escape. Whether such use of sexual behavior for a non-sexual goal is a true case of the domination of one drive over another is

ASPECTS OF ADAP

1	2	3 Organic States	4	5
Common Names	Inducing Conditions (mainly environmental)	Persisting Chemical Factors in Blood or Tissue	Persisting Physical Sources of the Drive Stimulus	Bodily Structures Chiefly Involved
1. Hunger	Food deprivation	Deficiency of protein, carbohydrate, fat, etc.	Hunger contraction of the stomach	All tissues, especially the stomach
2. Nausea	Certain odors		Internal irritation	Upper alimentary tract
3. Thirst	Water deprivation	Relatively low H_2O in tissues	Dry condition of membranes	All tissues; especially mucous membranes of mouth and throat
4. Sex	Sex deprivation	Autacoid from gonads	Distended seminal vesicles (♂)	Reproductive organs
5. Nursing	Presence of young		Distention of acini in mammary gland	Mammary glands
6. Urinating	Various inducing conditions		Distended bladder	Bladder
7. Defecating	Various inducing conditions		Distended rectum	Rectum
8. Avoiding heat	High temperature		Cutaneous irritation	Blood vessels, sweat glands
9. Avoiding cold	Low temperature		Cutaneous irritation	Blood vessels, sweat glands
10. Avoiding pain	Noxious stimulations		Cutaneous irritation or damage to tissues	Skin receptors and neurons
11. Air hunger	Absence of air (oxygen)	CO_2		Lungs, diaphragm, and other parts
12. Fear and anger	Various "dangers"	Adrenin		Adrenal glands
13. Fatigue	Prolonged muscular activity	CO_2, lactic acid		Muscles and nerves
14. Sleep	Loss of sleep			Nerves
15. Curiosity, observation, manipulation	Novel objects, movement, intense stimulations			Receptors
16. Social instinct	Absence from the group			
17. Tickle	Stimulation of "sensitive zones"		Cutaneous or subcutaneous irritation	"Sensitive zones"

TIVE BEHAVIOR

6 Incentives	7	8	9	10
Goal-objects-to-be-sought	Objects-and-situations-to-be-avoided	Effect upon General Activity	Specific Reactions to Incentives, "Consummatory Reactions"	Final State of Affairs
Food		Increased restlessness, search for food	Salivation, chewing, swallowing	Food eaten
	Nauseating foods eaten, certain odors		Vomiting	Nauseating substances rejected
Water		Increased restlessness, search for water	Drinking reactions	Water drunk
Mate		Increased restlessness, search for mate	Various reactions, copulating	Copulation completed
Offspring			Nursing, retrieving and caring for young	Nursing completed
Suitable place to urinate			Urinating	Urine discharged
Suitable place to defecate			Defecating	Feces discharged
	High temperature	Increased restlessness, struggle if intense	Vaso-dilation, sweating	Complete escape from high temperature
	Low temperature	Increased restlessness, struggle if intense	Vaso-constriction, shivering	Complete escape from low temperature
	Agents which damage the tissues (cuts, burns, acids, etc.)	Restlessness or writhing, if persistent and intense	Reflex withdrawal	Injurious conditions avoided
Air (oxygen)		Restlessness or struggle	Inhaling air	Air gained
	Various "enemies" and dangers	Increased excitement, greater muscular strength	Biting, scratching, clawing, etc.	Dangers removed
Place to relax	Further activity	Quiescence, relaxation	Resting, relaxing	Rest, heightened activity level attained
Place to sleep		Quiescence, relaxation, sleep	Closing eyes, breathing deeply, sleeping	Refreshed condition
Various inducing objects and situations		Exploring	Looking, listening, manipulating	Complete "familiarity" with environment
Others of species			Observant reactions, vocalizations, joining company of others	Return to company of others
	Stimulating conditions	Restlessness or struggle	Various reflexes, squirming, struggling	Sensitive-zone stimulation removed

obviously open to question. One can argue that a true sexual urge was never aroused in these instances.

Be that as it may, there is no doubt that hunger behavior dominates thirst if the animal has been long deprived of food and only recently of water, and that thirst dominates hunger under a reversal of conditions. Also the preferential order for foods varies with the constituents of an animal's diet. Similarly, exploratory behavior inhibits sexual aggression, eating, and drinking, if rats are placed in a novel environment. Many such examples can be found to show that the relative dominance of behavior patterns is largely dependent upon circumstances. We are forced to conclude that *there is no immutable hierarchy of drives.*

Psychologists sometimes say that when two motives come into conflict the stronger always wins. But this is a truism so long as the only way to determine which motive is the stronger is to bring the two into direct opposition. The real problem is to discover, if possible, the conditions which regulate the strength of a motive, and to get some adequate measure which aids in the prediction and control of behavior.

Analysis and Differentiation of the Primary Drives. The problem of differentiating drives will be made clearer by a careful study of the table on pp. 150-151 which shows some of the more important aspects of adaptive behavior.

1. The first column gives the common names for the drives in question.

2. The second column lists certain conditions which induce adaptive behavior in organisms. Most of these are environmental, but some of them, as prolonged muscular activity (item 13) and loss of sleep (item 14) have an organic factor, induced by a particular environmental circumstance.

3 and 4. The organic states which are at the basis of the different forms of adaptive behavior are illustrated by the examples given in columns 3 and 4. Persisting chemical factors are mentioned in column 3; physical sources of drive are noted in column 4. The chemical factors are either internal deficiencies based upon some lack in the diet, or hormones and similar exciting agents.

5. Column 5 lists the bodily structures which are chiefly involved in the forms of adaptive behavior under consideration. The entries

in the list are of necessity abbreviated, being merely suggestive of the complex pictures which might easily be drawn.

6 and 7. Columns 6 and 7 list the incentives in the environment which are actively sought or avoided in the drives. The positive goal objects are listed in column 6 and the negative incentives in column 7. These columns contain the specific spurs and checks to purposive activity.

8, 9, and 10. The last three columns refer to different aspects of adaptive behavior itself rather than to the inducing conditions. Column 8 presents some characteristics of general activity. The reader will note that many persisting organic and environmental conditions induce a general restlessness, *i.e.,* a rise in the activity level; sometimes there is quiescence. From an interpretative point of view the general activity may be described as struggle, excitement, exploring, quiescence, etc.

Column 9 lists the specific reactions which appear in the presence of incentives and appropriate organic and environmental states. Every one of these bits of behavior could easily be described in detail if one wished to add to the picture. Many of these reactions have been called by Sherrington and others the "consummatory reactions."

The last column describes the final state of affairs after the drive has come to a close. This column specifies the goal or end-result towards which behavior moves. The types of behavior under consideration can be differentiated by reference to the end-states, which might also be called the natural or biological goals of life.

In every case of adaptive behavior there are: (1) some persistent organic or environmental condition; (2) a release of energy through neural excitation from the persisting condition; (3) behavior which, though random at the start, generally becomes directed towards some definite goal; (4) a final reaction or adjustment which changes the inducing conditions and thus brings the drive to a close. When a drive has disappeared from behavior it does not return until the inducing conditions are again present. With some drives the recurrence is periodic; with others it is sporadic and accidental.

The above analysis leads to a precise definition of drive. In the strictly physical sense, drive is energy which is released by com-

plex bodily and environmental stimulations. This released energy is shown internally in bodily changes (physiological drive) and outwardly in behavior (behavioral drive). There are different views of a single motivational process, which might be called the mechanical, physiological, and behavioral aspects of drive.

The definition of drive as energy must, of course, be broadened so as to take account of regulating and directing factors. There are distinct bodily mechanisms for releasing energy. Again, there are various internal and external conditions which furnish stimulation to the organism and which lead to energy release. With human motivation the regulating mechanisms may so markedly restrict behavior that one is likely to lose sight of the fact that motivation is essentially a process of energy transformation. Dogged determination, grit, persistence in tasks which involve relatively little energy release—thinking, tree-sitting, watching for someone to come home —are essentially *restricting and limiting* conditions of energy release rather than *exciting* conditions. Such factors will be considered in Chapter V.

Primary and Secondary Drives. Reference to the physiological state of an organism is a sound basis for differentiation between primary and secondary drives. This, for example, was the ground of Tolman's distinction between two orders of drives. He stated that first-order drives are those dependent upon physiological needs. These are of two subclasses: (*A*) *cravings* (hunger, sex, fatigue demands, excretion demands, sensitive-zone demands); and (*B*) *aversions* (fear and pugnacity). Second-order drives, on the other hand, have no obvious physiological basis but are contributory to the first-order drives. Tolman gives the following examples of second-order drives:

> *Curiosity:* to get more stimulation from some distant and unfamiliar object.
> *Gregariousness:* to seek and stay in presence of others.
> *Self-assertion:* to dominate and control others.
> *Self-abasement:* to submit to others.
> *Imitativeness:* to copy the ends pursued by others.

Second-order drives can be identified by the characteristic trend

of gross behavior rather than by any purely physiological state. Both first- and second-order drives may be either positive or negative.

Tolman's distinction is similar to that of this author. We recognize that certain primary drives depend upon persistent organic states. *A drive,* in our sense, *is primary when the physiological basis for the purposive behavior has been clearly demonstrated, and when it has been differentiated from the organic bases of other drives.* Hunger, thirst, male and female sex behavior, maternal activity, and so on (pp. 103-131), are primary drives which can readily be differentiated in bodily terms. All other drives will tentatively be called secondary until a specific organic basis can be clearly demonstrated. Some secondary drives depend upon persisting environmental conditions such as novelty, or the presence of other members of one's species (items 15 and 16, pp. 150-151).

Still other secondary drives are built up within the developing personality in a social environment. These determinations are made understandable only by referring to the life history of the individual in relation to his social world. In this class are the peculiarly individual phobias, wishes, purposive determinations, tics, and the like.

Inclinations to Act and Their Bodily Basis. If all the tissue needs of an organism could be met simultaneously, a condition of quiescence and placidity would exist. Such a hypothetical state of indifference is represented by a point at the center of Fig. 41.

If such a need-free organism were suddenly deprived of air, a condition of air hunger would quickly develop and its intensity become maximum in a short time. Restless movements and struggling would ensue; if air were not obtained, the permanent quiescence of death would soon follow. Air deprivation has immediate physiological effects which are profound and widespread, and which quickly reach a maximum. Again, if the hypothetical need-free organism were deprived of water, other conditions remaining constant, restless movements would appear; in experienced organisms there would be water-seeking behavior. If water were not obtained, the animal would become weaker and increasingly depleted until death restored a permanent quiescence.

The sexual urge is different from the others in that a permanent

deprivation tends to destroy the species rather than the individual. Sexual drive varies in degree according to the organic state, the opportunity afforded for sexual activity, and many other conditions.

These and similar inclinations can be examined from various points of view. To the behavioral psychologist an inclination is an

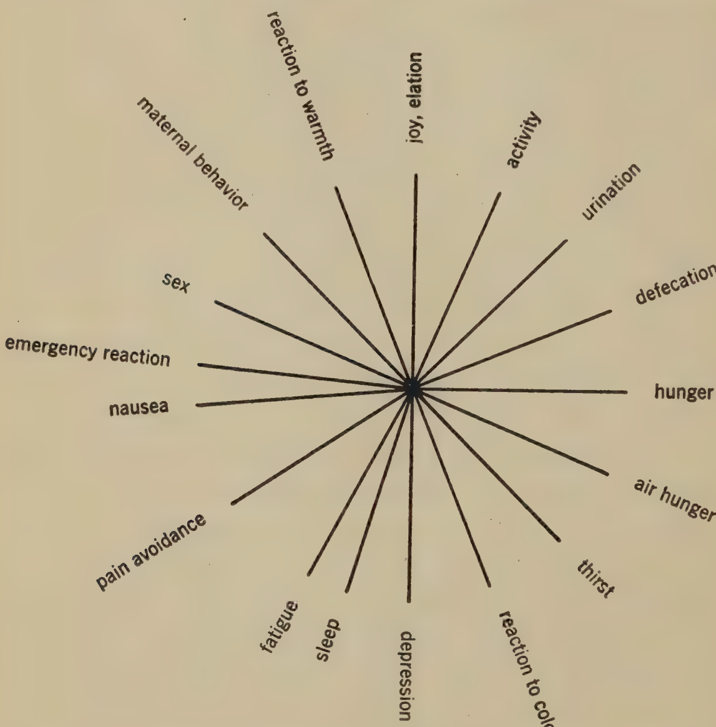


FIG. 41. DIAGRAM OF THE SIMPLE INCLINATIONS TO ACT WHICH ARE PHYSIOLOGICALLY DISTINCT.

The central point represents the hypothetical need-free state of an organism; the lines, possible directions in which inclinations develop. The departures from indifference can be regarded (from different points of view) as behavioral inclinations, as persisting physiological conditions, or as conscious demands (cravings and aversions).

incipient movement or a preparatory set for some specific movement. To the physiologist an inclination is an internal bodily process or state which incites the organism. To the experiential psychologist an inclination is a conscious demand, a craving or aversion. Despite these differences of viewpoint, it is here assumed that there is a single process going on in the organism. The term "inclination"

refers to this process regardless of the viewpoint from which it may be observed.

Each dimension implies the possibility of a continuous series of departures away from the hypothetical zero point. There are not only departures away from the zero point but also returnings to it.

One of the dimensions is that of general activity. The level of activity as we have seen (pp. 52-65) varies with a host of conditions, such as the period of food deprivation, temperature, and hormone balance. With prolonged muscular activity, fatigue develops. There are varying degrees of fatigue from a mild demand for quiescence to a condition which the individual cannot voluntarily resist. Fatigue and sleep are both opposed to increase of activity; hence they are represented on opposite sides of the indifference point to general activity.

A number of the dimensions in Fig. 41 represent behavioral inclinations which depend upon well-defined inner and outer conditions. Examples are: the inclination of a mother to reach and nurse the litter, the inclination to vomit or to reject nauseating substances (represented by the nausea dimension), the inclination to defecate, to urinate, to avoid painful stimulation, to move toward warmth and away from the extremes of heat and cold. These inclinations rest upon definite organic and environmental conditions.

For most of the dimensions shown, the corresponding organic states can be differentiated, but this is not true of persistent moods of joy-elation and depression. Until the basis for persistent elation and depression is definitely known this dimension remains different from the others in that a physiological foundation is assumed rather than demonstrated. Cases of manic-depressive insanity, however, imply that there is some very specific bodily basis for pathological elation and depression. The states are functional opposites; it is quite correct to place them on the ends of a single line which passes through the indifference point.

Separate dimensions for anger and fear have not been shown. The reason for this is that fear and anger are alike physiologically; the difference between them lies in the dynamic behavioral relations between organism and outer situation, and in the corresponding mental attitudes of anxiety and hate. Fear, anger, as well as general excitement are all reactions to a biological emergency, which

have not yet been differentiated on a purely bodily basis (pp. 139-141).

As explained in the previous section, the bodily state of an organism is extremely complex, and the conditions which predispose it toward one activity or another are interrelated. Some inclinations are incompatible, as those to fatigue and heightened activity, to hunger and nausea, to anger and sex; others are compatible and often supplementary, as those of hunger, thirst, cold, pain-avoidance, and air hunger.

At any given time the total organic state inclines the organism towards one kind of activity or another. The dimensions shown in Fig. 41 indicate some of the possible inclinations toward different forms of activity. If one could map out all the significant dimensions, and determine at any moment the organism's exact degree of inclination along every dimension, representing the strength of each inclination by a point on the dimension, then the line joining these points would portray the total pattern of behavioral inclinations at the moment. For example, at a given time an organism might be moderately fatigued, depressed, quite distinctly inclined to sleep, with moderate hunger, having specific urges to urinate and to avoid a cold and painful environment. This hypothetical pattern of inclinations could be represented by an ameba-shaped figure made by joining the points on the various dimensions.

Actually what a man is inclined to do at a given instant depends upon the totality of complex conditions, differing in health and disease, in hunger and satiety, in cold and warmth, and so on. The total state is constantly changing, and one physiological variation is likely to have numerous interrelated effects, as we have previously seen. The separate organic conditions are so interdependent that a complete analysis has not yet been made. The diagram in Fig. 41 pictures a preliminary analysis, based mainly upon the list of drives which have been differentiated physiologically.

Moods. The term "mood" refers primarily to the persistent affective consciousness of an individual, but moods are also manifest in behavior. The organic conditions which determine the individual's inclinations to act determine also his feelings. One speaks of feeling depressed or elated, fatigued or ready-to-go, anxious,

hungry, annoyed, satisfied, and so on. All these and similar persistent feelings depend directly upon the organic state.

It is commonly known that good news, financial stress, success or failure in love, a game of golf, a concert, and many other events profoundly change one's mood. The effect of environmental conditions varies markedly from individual to individual.

To illustrate the changeableness of moods and their environmental basis note the following description and comment by MacCurdy:

> A man wakes in the morning, feels sluggish, does not want to get up, and succeeds in doing so only with effort. He forces himself to go through his toilet ritual and dresses, although every minute sees a diminution in the effort he is called upon to make. This is like a miniature depression. He goes down to breakfast and is irritable because his coffee is cold; he scolds his wife and discovers some naughtiness in his children; after commenting harshly on this he retires huffily behind his newspaper. This mood accompanies him to his office, where he complains of the inefficiency of his staff. But soon a man comes in with whom he concludes an important bit of business. Elation sets in and he makes mildly erotic advances to his stenographer. He lunches with some friends at his club, drinks a little, and becomes jovial, laughs boisterously at his own jokes. In the afternoon, it seems that the deal he thought was consummated may not be securely settled. He begins to worry over this and other transactions as well. But soon he finds that his venture is going to go through and he returns home in a cheerful frame of mind. Here he repairs to the nursery, and runs around on his hands and knees with his children, uses baby talk and, in general, indulges in behavior that in any other environment would stamp him as insane.

This picture is slightly, if at all, overdrawn. We do show variations in our reactions in the course of even a single day that are like those of manic-depressive insanity, although none of the changes are extreme as in the psychosis. In the main we see that these alterations are produced by variations in the environment. In manic-depressive insanity quite dramatic shifts occur without any discernible external causation. Now if we suppose that the stimuli, when a man is insane, come from within rather than without, a possible explanation is forthcoming. We know that the greater the intensity of a psychosis, the less is the contact with the surrounding world, the

more, therefore, must the patient be living in an inner world of his own creation.

The quotation from MacCurdy illustrates the importance both of environmental and of organic factors in the determination of mood. It also shows the fact that moods are exhibited in behavior as well as consciously felt by an individual. It does not much matter whether one's interest centers in the descriptive analysis of conscious processes or in the facts and conditions of human behavior. In either case these persisting affective states continue as phases of a natural process, and the aim of psychology is to formulate principles which are independent of any limited interest or viewpoint.

THE INSTINCT DOCTRINE

Any serious consideration of drives leads sooner or later to an examination of the traditional doctrine of instinct. The previous generation of psychologists sometimes referred to instincts as if they were motivating factors.

Opposed to this view are two modern descriptive definitions of the term. These current views of instinct call for serious consideration:

1. **Instinct As Unlearned Reflex Behavior.** Some patterns of behavior are clearly present at birth; others appear later in the life cycle of the organism quite apart from practice and training. Web-building in the spider, the pecking reaction of the chick, crying in the infant, are examples of unlearned activities. These behavior patterns are common to all members of the species, and appear in the appropriate environmental situation independently of training.

Some unlearned activities are relatively simple, such as constriction of the pupil when a bright light is thrown upon the eye, withdrawal of the hand or foot from a painful stimulation, and the vegetative reactions involved in circulation, respiration, ingestion, digestion, and excretion through the skin, colon, and bladder. Other activities are much more complex. The serial reactions of insects in nest-building, egg-laying, mating, locomotion, involve reflexes which are chained or linked together into a complex pattern. Herbert Spencer defined instinct as compound reflex action; but the

difference between simple and compound reflex action is obviously a relative and arbitrary one.

An excellent illustration of unlearned behavior can be found in Carmichael's experiment with embryos of the frog (*Rana sylvatica*) and salamander (*Amblystoma punctatum*). In this work larvae were raised from fertilized eggs in a chloretone solution, which was weakly anesthetic, inhibiting movement but not growth.

When the solution was removed and the embryos were placed in ordinary tap-water, they began to move and responded to external stimulation in periods of time averaging less than twelve minutes. "In varying lengths of time after this first movement, but in all cases in less than thirty minutes, the previously drugged embryos showed coordinated swimming movements. In fact a number of the eighteen *amblystoma* embryos swam so well in less than one half hour after they had shown the first sign of movement, that they could with difficulty, if at all, be distinguished from the members of the control group who had been free swimmers for five days."

The appearance of these coordinated movements of legs, trunk, and tail in swimming, when no opportunity for practice could possibly have existed, is conclusive evidence that these locomotor reactions are congenital.

Further illustrations are found in the work of Tilney and Kubie, and of Stone. Tilney and Kubie plotted out the stream of behavioral development in the rat, the cat, and the guinea pig. Reactions of the kitten such as turning the eyes and head, sitting, lapping, appear suddenly on the fourteenth, twentieth, and twenty-ninth days, respectively. Other reactions develop more gradually over a period of days. Crawling, for example, is present on the first day of the kitten's life and continues to develop through the sixteenth day. With the guinea pig many reactions are present at birth or appear suddenly during the first day.

Stone demonstrated that sexual reactions of the adolescent albino rat develop quickly within a period of a few days. It is likely that the sexual reactions depend upon the introduction into the blood stream of a chemical factor coincident with maturing of the reproductive glands. Stone's work suggests that the process of maturing has at least two aspects: (1) the development of neuromuscular

structures, and (2) the development of the glandular organs which secrete hormones into the blood. Structural maturation is thus the basis of behavioral maturation.

The unlearned reflexes, whether simple or compound, must be explained in the following terms: (1) the stimulation of receptors; (2) the structure of the body, especially the structure of the nervous system; (3) the chemical agents which regulate the excitability of reactions; and (4) the process of maturation. Bodily structures mature at various stages of growth; along with this maturation some behavior patterns appear and others vanish.

2. Instinct As Unlearned Purposive Behavior. There are those who believe that the principle of reflex action is inadequate to explain instinctive behavior. *"INSTINCT,"* wrote William James, *"is usually defined as the faculty of acting in such a way as to produce certain ends, without foresight of the ends, and without previous education in the performance."*

Before we consider this view of the instinct doctrine critically it is well to have concrete examples before us. Instincts are most clearly apparent in the behavior of insects whose complicated activities produce certain results "without foresight of the ends, and without previous education in the performance." McDougall has described the behavior of the wasp as follows:

> The wasp, while building her cell, seems wholly dominated by the one tendency. She seems indifferent to other appeals, *e.g.,* to food and to male wasps. She is concentrated on her task. The one tendency seems to have right of way and to make use of all her motor capacities and powers of adaptation. Hour after hour she flies busily to and fro, bringing her pellets of clay and working them into her cell. Such concentrated activity with great output of energy is characteristic of instinctive behaviour. Interruption may occur; but the creature returns to her task as the magnetic needle swings back to the pole after forcible deflection. And when the natural end or goal of that train of activity is attained, she desists, flies away and seems to have no further *interest* in the matter. It is not that the apparatus is worn out. It is not that the creature is exhausted. In respect of this directed activity, sustained until the natural end or goal is reached and then abruptly terminating, our mechanical analogy breaks down; and here again the reflex-theory of instinctive action is inadequate. Such persistence of activity until, and only

until, the natural goal is reached is one of the objective marks of the teleological, purposive, or goal-seeking nature of the whole train of activity.

Human behavior, as truly as animal, exhibits instincts. In a recent book McDougall has listed the following, changing the name from "instinct" to "propensity":

1. To seek (and perhaps to store) food (food-seeking propensity).
2. To reject and avoid certain noxious substances (disgust propensity).
3. To court and mate (sex propensity).
4. To flee to cover in response to violent impressions that inflict or threaten pain or injury (fear propensity).
5. To explore strange places and things (curiosity propensity).
6. To feed, protect and shelter the young (protective or parental propensity).
7. To remain in company with fellows and, if isolated, to seek that company (gregarious propensity).
8. To domineer, to lead, to assert oneself over, or display oneself before, one's fellows (self-assertive propensity).
9. To defer, to obey, to follow, to submit in the presence of others who display superior powers (submissive propensity).
10. To resent and forcibly to break down any thwarting or resistance offered to the free exercise of any other tendency (anger propensity).
11. To cry aloud for assistance when our efforts are utterly baffled (appeal propensity).
12. To construct shelters and implements (constructive propensity).
13. To acquire, possess, and defend whatever is found useful or otherwise attractive (acquisitive propensity).
14. To laugh at the defects and failures of our fellow-creatures (laughter propensity).
15. To remove, or to remove oneself from, whatever produces discomfort, as by scratching or by change of position and location (comfort propensity).
16. To lie down, rest and sleep when tired (rest or sleep propensity).
17. To wander to new scenes (migratory propensity).
18. A group of very simple propensities subserving bodily needs, such as coughing, sneezing, breathing, evacuation.

It will be noted that McDougall's list of propensities is a classification based upon observation and analysis of the things men actually do.

Koffka is another psychologist who has denied the validity of the view that an instinct is a series of reflexes chained together into a mechanical series. A more correct picture, he believes, is that of behavioral trends which move in a fixed direction until certain requirements have been met. "Consider the building of a nest. One cannot say at any particular stage in its construction that the bird will now make this or that movement; one can say, however, that the bird must now fulfil this or that requirement."

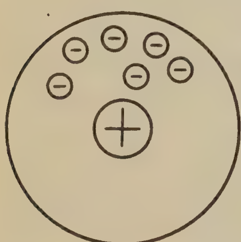


FIG. 42. REPRESENTATION OF PHYSICAL TENDENCY TOWARD AN END-STATE OF EQUILIBRIUM (*explanation in text*).

Koffka distinguished between "closed" and "unclosed" physiological systems to account for the fact that behavior as a whole shows "closure" or the tendency toward completion of non-completed activities. The view does not imply any vital force.

Behavioral tendencies, as Köhler has pointed out, exist in the physical world. As an example of a physical tendency consider a flat pan of water with a positive static charge on some object in the center, Fig. 42. On the surface of the water are several corks, each carrying a small object with a negative charge. Regardless of where the corks are placed or how they are initially disturbed, they gradually arrange themselves into a symmetrical pattern about the central positive charge in accordance with the physical principles of resolution of magnetic forces. It is correct to speak of a *tendency* towards physical equilibrium, and this manner of speech implies no vital force, no awareness of purpose on the part of the charged bodies.*

Similarly when a dog chases a rabbit the course of his behavior follows that of the rabbit. The dog jumps fences, fords streams, climbs obstacles, digs—and all these actions are directed toward the rabbit-goal. In such an example it is hardly correct to speak of chained reflexes or even of habits, because the situation calling out

* This illustration was used by Köhler in a lecture at Berlin.

the behavior is never twice the same. The significant feature is the direction of behavior towards a goal or end-result.

McDougall states that an instinct is to be defined and recognized not by the kind of movements in which it finds expression but rather by the kind of change in the animal's environment which brings the train of behavior to a close. This suggests Koffka's closure theory; it suggests Raup's complacency doctrine, and the previous discussion of homeostasis and equilibrium (pp. 81-84).

Critique of the Instinct Doctrine. There have been so many criticisms of the instinct doctrine that it would be misleading to drop the topic without first pointing out a few of the difficulties and objections to the conception.

1. *The difficulty of demonstrating which elements of behavior are learned and which unlearned.* One difficulty with the investigation of instincts is that of determining how far the activity in question is really unlearned and how far it is acquired. We commonly assume, for example, that cats kill mice and rats instinctively, but the Chinese psychologist, Kuo, has reported a study which throws doubt on this assumption. Several groups of cats were reared in different environments, some with rats as cage companions and others only with cats. The cats reared with rats never killed a rat of the same species although there was ample opportunity to do so, whereas the other cats, reared with rat-killing mothers, themselves became rat-killers at the age of four months. Kuo argued that, if there is a rat-killing instinct in cats, there is also an instinct to love them. All depends upon the environment.

Another instance in point is that described by Admiral Byrd in a lecture upon the South Pole. He and his men found penguins on the ice which never before had seen human beings. These strange birds showed not the slightest fear when the men approached and the dogs barked at them. Byrd remarked, "Where there is nothing to fear, fear is undeveloped." Do the penguins actually lack an instinct to fear? Would fear develop in an environment of constant danger?

The environment, it has been argued, is an all-important factor in calling forth types of behavior generally regarded as instinctive. The organism, from fertilized egg to death, is constantly interacting with its environment: it is never easy to say just how much develop-

ment depends upon reaction to the environment and how much upon those chemical determiners of growth which reside in the chromosomes.

In such activities as food-seeking and nest-building there are both learned and unlearned factors. The unlearned factors are found in the bodily structures and the tissue conditions which determine the drive. The learned factors can be referred to the particular environments of an organism. Purposes are built up out of purposeless reactions; goal-directed behavior often comes into existence gradually; but it is always difficult to put one's finger on the unlearned factors of goal-directed behavior.

2. *The fallacy of hypostatization.* Another difficulty with the instinct doctrine is the common assumption that "instincts" explain behavior. When stated bluntly the fallacy of hypostatization is clearly apparent: Monkeys swing through the trees in small groups or gangs. Why? Because they have a "gregarious instinct?" But how does one know that monkeys have a "gregarious instinct?" Why, because they travel in groups!

Holt has stated this objection to the instinct doctrine in the following words: ". . . man is impelled to action, it is said, by his instincts. If he goes with his fellows, it is the 'herd instinct' which actuates him; if he walks alone, it is the 'anti-social instinct'; if he fights, it is the instinct of 'pugnacity'; if he defers to another, it is the instinct of 'self-abasement'; if he twiddles his thumbs, it is the thumb-twiddling instinct; if he does not twiddle his thumbs, it is the thumb-not-twiddling instinct. Thus everything is explained with the facility of magic—word magic."

Instincts, in a sense, have been invented by the psychologists and philosophers. They may describe unlearned patterns of behavior, but they really explain nothing. Instincts are not motivating agents.

3. *The difficulty of classification.* There is another difficulty which has to do with the classification of instincts. Any classification of behavioral tendencies in terms of purpose is arbitrary; there are as many possible classifications as there are classifiers. One can argue convincingly that behavior has but one purpose, one instinct, which is preservation of life. One can claim equally well that there are two instincts, self-preservation and race-preservation. Or one can insist that there are three, four, six, ten, forty, or a hundred,

depending upon one's purpose in classifying. Or with Kuo one can maintain that there are no instincts! All depends upon the bias or point of view of the classifier; and one *a priori* system is superficially about as good as another.

À propos of the difficulty with classification is the following amusing incident related by a distinguished economist. When a young man, he and his bride decided to keep accounts, and agreed to list all expenditures in two books. One was entitled "household expenditures," and the other with gold letters was marked "the higher life." All went well until the young husband discovered that four loads of manure, purchased for the garden, had been entered under "household expenditure." He objected to the classification. His bride, on the other hand, was unwilling to place the item under "the higher life." The final outcome was a discontinuance of the accounting system. Any classification is likely to meet with difficulties the moment one becomes critical of it.

A classification is for convenience only. If a system of instincts, such as that of McDougall or Thorndike, is practically useful, there is no reason why one should not employ it.

In conclusion, the author believes that the term "instinct" is useful to describe unlearned patterns of behavior (reflexes), and to refer to the innate factor in learned purposive activities such as food-seeking, mating, and so on. The word itself explains nothing. Explanation of instinctive behavior must be sought along various lines. First, one can explain by giving a detailed account of bodily mechanisms. Second, one can explain by tracing out the growth of bodily structures and the concurrent maturation of behavior. Third, one can explain by showing how purposive behavior is acquired out of random meaningless activity in the process of learning.

THE ACQUIRING OF PURPOSES

The student of motivation can hardly avoid noticing the purposive character of drives. In fact, the fundamental urges are best described by reference to their goals or end-situations.

In many cases the directing of behavior towards a goal is obviously acquired. To illustrate, the rat learns to run a maze in the shortest path from starting-box to food. During the first few trials

there is random activity, but if food is repeatedly found at the same spot, the aimlessness of behavior disappears. The rat learns to start right out in a businesslike manner as if determined to go somewhere.

In every instance of persistent purposive behavior in which the animal appears to be seeking some objective, definite motivation is present in the background. Usually, if not always, purposive seeking implies the previous existence of a process of learning and past experiences by means of which the goal-oriented behavior developed.

In the laboratory, when an animal is given a problem to be solved or a task to be learned, the first essential is to provide adequate motivation. Theoretically, any kind of genuine motivation may induce learning.

What Kinds of Motivation Have Actually Been Used in Experiments upon Animal Learning? In 1921, Maupin reviewed seventeen studies upon the acquisition of animal behavior and listed the incentives used, with the following result:

Food, with hunger, used ten times.
Escape from confinement or release, used four times.
Punishment, used twice.
Society, shade, nest, each used once.

In the experimental literature upon animal learning, various incentives and motives have been utilized. The *light-avoiding* reaction of cockroaches, for example, has been made use of by Turner and by Szymanski. Roaches are nocturnal animals which "love darkness rather than light." When placed in a bright light they scamper hither and thither until a dark place—some hole or crevice—is found into which they immediately rush. By means of an electric shock used as punishment, roaches were trained to avoid entering a specific dark place. The number of trials necessary to establish this habit varied with the individual subject. Szymanski trained ten cockroaches to avoid the dark on ten successive trials; the insects learned to do this after the following numbers of trials, respectively: 37, 28, 116, 16, 96, 44, 32, 23, 37, 118. The figures show considerable variation in learning time.

Turner also found marked individual differences in the learning and retention of cockroaches. He states that the negative reaction

to light is not a tropism, in Loeb's sense, because there was no orientation to the rays of light. There was simply restless, random behavior which ceased only in the dark. The avoidance of light in the roach thus appears to be a basic drive which depends upon some effect of persistent light stimulation.

Another type of motivation which has been used in learning experiments is the *urge to escape from water.* In an attempt to find a practically useful type of motivation other than hunger (which has been used the most frequently of all) Ruch tested the escape-from-water incentive. White rats were forced to swim the maze, and a record was kept of time and errors. Under these conditions the animals learned the maze. After a careful analysis of the types of errors and of the time scores Ruch concluded that the drive to escape from water is well adapted to the study of animal learning, and that the method has especial value when it is necessary to employ a form of motivation which is independent of hunger.

A different result was obtained by MacGillivray and Stone when rats were required to wade through the maze. In this experiment, the impulse to escape-from-water added nothing to hunger in speeding up the learning of a discrimination habit. This is not surprising, since *wading* is distinctly different from *swimming* in that it does not limit the ease of breathing. Swimming, on the other hand, forces the animal to be active in order to breathe. One obvious energy-releasing factor which needs to be controlled in experiments utilizing both swimming and wading is the *temperature* of the water.

Various other types of motivation have been used in the study of learning. Szymanski, in 1918, in a survey of motivating conditions, raised a fundamental question when he asked: "What kinds of motivation can evoke animal learning?" After considering the available evidence and making a number of experiments he concluded:

1. *Hunger* is sufficiently strong to motivate maze learning with rats and dogs.

2. *Pain* is adequate as an incentive to learning; as, for example, an electric shock with white mice, or a mechanical blow with canary birds.

3. *Limitation of freedom and of the ease of breathing,* as in a goldfish placed in shallow water, evokes learning of a labyrinth.

4. *Social motivation* has proved effective in the maze learning of ants (Field) and of chicks (Thorndike).

5. Mere *return to the nest*, of itself, furnishes weak and insufficient incentive for learning, for white rats.

6. The *maternal drive* is strong enough to produce learning with some female rats but not with all. (*Cf.* Warden, p. 149.)

Szymanski also worked out three important general principles:

1. If the motivation under which an act was learned is removed, the act becomes less well performed; for example, if rats have learned a maze when hungry, they make more errors and are more variable in their performance when satiated.

2. If an animal is led or forced through the maze along the true path, in other words if he is "put through," this does not facilitate subsequent learning of the same maze under an adequate motivation such as hunger.

3. If an animal fails to learn the maze because of inadequate motivation, but nevertheless goes through it, exploring actively, this facilitates subsequent learning when adequate motivation is provided.

These three principles are important from the standpoint of the theory of motivation. They emphasize the general truth stated earlier in this section that some motivation is necessary in experiments upon animal learning; without it the animal simply will not continue to work upon his task. Putting it still more broadly, the first essential in all animal experimentation, whether it be upon learning, discrimination, delayed reaction, thinking, or other psychological problem, is to supply adequate motivation. Professor Washburn has stated this basic principle concisely in the quotation which heads Chapter III (p. 87).

After looking over the experiments described in the literature upon animal motivation, one can summarize as follows the main factors which have led to learning: hunger combined with different kinds of food, thirst, pain-punishment with electric shocks and blows, immersion in water with escape by swimming or wading, limitation of freedom and release from such confinement, restriction of breathing, removal of the litter from the mother, removal of animal from the nest, presence of sexual mate, presence of a companion in a social situation, high or low temperature of water in

swimming tank, auditory stimulation from a continuously sounding electric buzzer, bright light for light-shy animals.

If we inquire, "What kinds of motivation effectively induce *human* learning?" many varieties must be added to the above list. Social forms of motivation—praise, reproof, rewards, penalties, competition, rivalry, prestige, and so on—all lead to human learning. The variety of effective rewards such as prizes, money, and various symbols as badges, loving cups, honor rolls, is much greater with human subjects than with animals. Self-esteem plays a more important motivating rôle with human beings. Verbal commands, instructions, and orders are efficacious.

Does Unmotivated Learning Occur? This question has frequently been asked. The answer, like that to so many other questions, depends entirely upon one's definition of terms.

If the sphere of motivational psychology be limited arbitrarily to the study of purposive behavior, it is clear that unmotivated learning does occur. That is to say, the neural organization of an individual may become modified quite apart from any specific goal-seeking or conscious intention. Consider a man who happens to witness a horrible accident. His observing, running, screaming, trembling, and so on, leave lasting impressions upon his neural organization; the individual's subsequent behavior and conscious experiences are different because of these chance reactions. This might reasonably be called an example of unmotivated learning.

If, on the other hand, the field of motivational psychology be defined broadly enough to include the causal explanation of all organic movements that go to make up behavior, whether goal-directed or not, then every reaction and every modification of reaction is, by definition, motivated. The statement simply means that every modification of behavior is causally determined.

The author prefers the broader formulation of the basic problem of motivational psychology, which implies that all learning is motivated. Part of our task is to study the ways in which purposive behavior develops out of aimless activity. Purposes themselves are learned or acquired; how they develop will now be considered.

The Acquiring of Position Goals and Spatial Orientation. One sometimes hears it said that insects and other animals find

their way about by means of a mysterious "sixth sense" or an instinct of direction. The statement is generally supported by anecdotes of a marvelous nature. Who has not heard stories of pet cats and dogs finding their way home from great distances?

Careful studies of bees, wasps, and other flying insects, however, have shown that they *learn* to find their way about by relying upon sensory cues, mainly visual ones. Walking insects depend upon olfactory cues or an olfactory trail. Carrier pigeons, cats, and dogs return home from great distances only when they have had an opportunity to explore the vicinity of their homes or when by chance they make contact with a previously explored territory.

In other words, there is no scientifically sound evidence for a "sixth sense" of direction, but much for the view that animals *learn* to find their way about by depending upon ordinary sensory aids. Orientation in space is thus to a large extent acquired.

This is obviously true of the rat in a maze. When first placed in the labyrinth a hungry animal explores, and discovers food by chance. With repeated trials the entrances to blind alleys tend to drop out. Finally the rat runs continuously from start to goal; his path is direct; he appears to know where he is going and why.

An illustration of a typical laboratory set-up for studying learning and motivation with rats is presented in Plate V. In running the maze a rat is confronted with a series of right-left choices. For example, at the start there is a choice between the blind alley, shown at 2, and the correct path, 3. At the end of 3 there is another choice—between the blind alley, 4, and a true path leading toward 7—and so on.

Another example of the acquiring of spatial orientation is found in one of Yerkes's studies with the green frog. This animal's urge to escape from bright light and to return to water furnished motivation for his behavior in the experiment. In addition, an electric shock was administered for wrong choices. With this combined motivation the frog learned to escape by a direct path.

The general plan of the apparatus is shown in Fig. 43. A blind alley to the animal's right, shown in the upper diagram, was painted red. Vision of the red surface, and the constant need for turning at first to the left, both proved to be important factors in establishing the habit.

After the labyrinth had been completely learned the frog hopped along a direct path from start to exit. The red *cul de sac* was then changed from the animal's right to his left, and the exit was similarly changed. The path of the frog on the first trial after reversal is shown in the lower diagram of Fig. 43. Note that there was at first a persistence at the left of the apparatus despite the red color

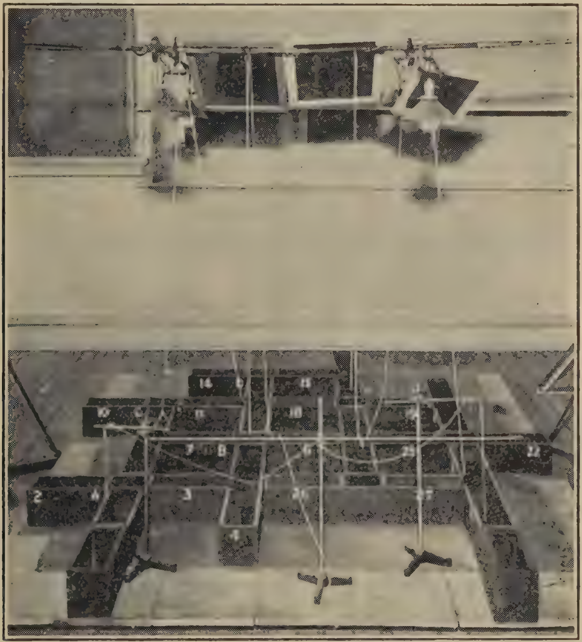


PLATE V. MULTIPLE-T MAZE USED TO STUDY MOTIVATION. (*University of Illinois Psychological Laboratory, courtesy of E. E. Anderson.*)

A movable starting-box may be seen in the left foreground, and a movable goal-box, similarly located, at the right. The mirrors and lights above the maze make it possible for the experimenter to observe the rat in all positions and to record his progress from start to finish. The strings are for the purpose of closing the pathway at certain points after the rat has made a choice, in order to prevent retracing of the maze.

signal there; the thoroughly learned spatial habit of turning to the left still dominated behavior under reversed conditions. When finally the frog moved forward beyond the blind there was an equally determined attempt to escape from the maze at the right, which had been correct before the maze pattern was reversed. The animal failed completely to make an escape and was finally removed from the labyrinth.

The important point is that the spatial habit of the frog, to turn first to the left and then to the right, persisted despite a complete reversal of conditions. There were many changes of bodily posture as the frog hopped about; certainly overt posture could not have been the determinant of this behavior.

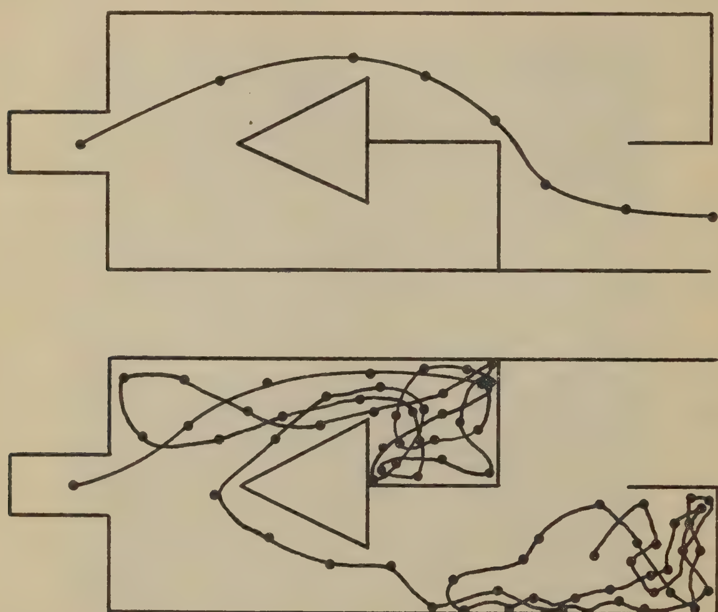


Fig. 43. Path Taken by Frog in Escaping from Labyrinth. (*After Yerkes.*) Upper curve shows path of frog with a perfectly formed habit; dots represent the sequence of jumps from position to position. Lower curve shows path of frog on the first trial after a reversal of the usual conditions.

Similarly, when a rat runs the maze or when a bee is flying back to the hive there is constant change in bodily posture, but despite this fact the animals find their way about. Obviously an acquired inner organization is the basis of spatial habits. Psychologists have assumed that this organization lies within the nervous system.

An interesting example of spatial orientation was described to the author by Malcolm Campbell. A police dog had been trained to carry his tail between his teeth. During an exhibition of this trick the trainer usually stood at a distance and ordered the dog to bring his tail. The dog then picked up his tail and walked to the trainer.

The path followed by the animal is the point that interests us here. It was in the form of an epicycle, shown approximately in Fig. 44. The curve of the path had two components, the first, rotational; the second, linear. The rotational component clearly depended upon the postural adjustment of the animal; his head was constantly oriented toward his tail, and because of this, progressive walking was walking in a circle. The linear component depended upon the position of the trainer, and an inner set of the dog to approach him.

In going to the trainer the dog's eyes and head were at times actually facing directly away from him; nevertheless steady progress was made in the intended direction. How was this possible?

FIG. 44. PATH TAKEN BY A POLICE DOG IN BRINGING HIS TAIL TO THE TRAINER. As seen from above there is a circular component shown by the broken line and a linear component shown by the arrow.

Some inner determination gave the directional orientation of the body, and this was dominant despite complete bodily rotation.

It is probable that the linear progression depended mainly upon vision, and that despite rotation there were frequent visual adjustments to the trainer's position in the field. Conceivably, hearing or other sensory processes may have played some part. Even so, one must assume a determination or set "to go to the master" which directed behavior.

The experiment can be duplicated under human conditions by instructing the subject to move toward a door or other fixed position while turning around and around so as to face all directions as does a toe dancer. If this be done with eyes open, it will be noticed that the general orientation towards the door or other goal is visually determined. At all times one is aware of the lay of the land. With eyes closed the orientation is still retained in visual

imagery, and muscular strains and pressures play a part in the process. The writer has been told by a young woman who is an expert toe dancer that she always fixates some light or bright object for orientation while spinning around, and then rotates her head quickly so as to fixate the same object on the next whirl.

When an animal or man goes in a definite direction we say he has a purpose. Feed the cat once or twice at the back door, and the creaking sound of this opening door brings her quickly to the spot. The purposive character of her behavior has been acquired, for at the start that particular door-creaking sound did not bring her. The acquired neural organization is latent as the cat roams about the yard, but when the auditory stimulation occurs it builds up in her a motor adjustment which directs pussy to the doorstep.

In the above examples several psychological principles are revealed. (1) Spatial orientations are maintained by peripheral cues. (2) Animals learn to find their way about in space, building up neural organization in the process. (3) Behavior is dominated by inner determinations which utilize the acquired organization, and are restricted by it.

The Goal Gradient. The goal-gradient hypothesis, formulated by Hull, states that as an animal approaches the goal-box of a maze the speed of running tends to increase with positive acceleration. The level of excitability varies inversely with the distance between animal and goal, according to a logarithmic law.

To measure the goal gradient Hull devised a straight forty-foot runway for timing the speed of locomotion of rats as they ran from a starting place at one end of the pathway to a food reward at the other. The path of this apparatus was broken into eight five-foot sections by valves of stiff cardboard which the rats lifted in running toward the food. These valves prevented retracing of the path, and also made electrical contacts which were used in timing the running speed.

The results indicate clearly that a hungry rat runs faster and faster as he approaches the food. Just before he reaches the goal, however, the speed of locomotion is slightly retarded. Practice tends to speed up the animal in all sections of the runway, but this effect is more pronounced in the first sections. Practice thus tends to level off the speed-of-locomotion gradient.

After leveling through practice, the original steep gradient can readily be restored by creating conditions which render the motivation less effective. One of these conditions is the removal of reward. Figure 45 presents the results of one of Hull's experiments in the form of a graph which shows the effect of removing the reward. Another means of restoring the steep gradient is by feeding the animals before letting them run to the food. Satiation removes the drive and in this way restores and even accentuates the original steep gradient. Figure 46 shows the effect of satiation upon the goal gradient.

Compound gradients can be produced by training the animals on twenty feet of the runway and then extending the runway to forty feet.

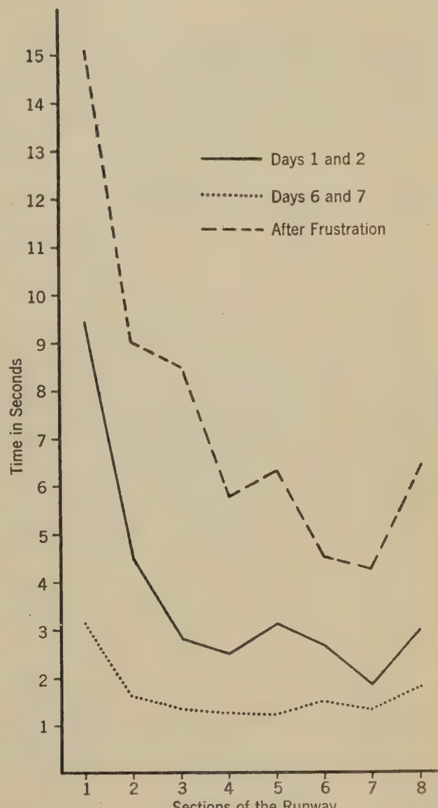


FIG. 45. COMPOSITE GRAPH FOR FOURTEEN RATS, SHOWING MEAN TIME CONSUMED IN TRAVERSING EACH OF EIGHT FIVE-FOOT SECTIONS OF A FORTY-FOOT RUNWAY. (*After Hull.*)

The solid line shows the speed-of-locomotion gradient on the first and second days. The dotted line shows the gradient on the sixth and seventh days, after practice. The dash line shows the restoration of the steeper gradient by frustration, *i.e.*, by removal of food after complete learning. Each point on the curve is the mean of 135 or 140 time measurements.

The contours of these compound gradients are rapidly obliterated by training.

The goal-gradient principle implies that in learning a maze the order of elimination of blind alleys will tend to be in a backward direction from goal to starting-box. Experiments by Spence, Tolman, Ruch, and others have in fact confirmed the hypothesis that nearness to the goal in space and time favors rapid learning. On

the average, the blind alleys of a maze are eliminated in a backward order from goal to starting-box.

Casual observation suggests that a principle equivalent to the goal gradient is operative in human behavior. If, for example, one has a definite objective such as sailing to Europe on June 16, one senses a general increase of excitement and activity as the time for departure draws nigh. If the goal is to attend a football game, the excitement grows markedly with the approach of the hour. The more important the event to the individual the more pronounced is this phenomenon. If the date for an election has been set, the activity and general excitement increase markedly with the approach of the voting day. The more important the issue of the election the more obvious is this gradient of excitement. Persons who plan a political campaign schedule their speeches, mass meetings, demonstrations, and similar events with increasing frequency as the fateful day approaches, thus unconsciously acting as if there were a logarithmic law in the activity gradient relative to the goal of voting.

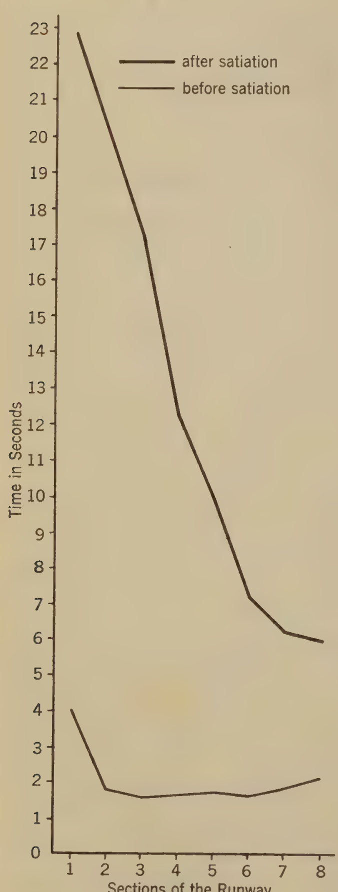


FIG. 46. COMPOSITE GRAPH FROM THIRTEEN RATS, SHOWING MEAN TIME CONSUMED IN TRAVERSING EACH OF EIGHT FIVE-FOOT SECTIONS OF A FORTY-FOOT RUNWAY. (*After Hull.*)

The lower curve represents the means from three days on which hungry rats were rewarded with food. Inasmuch as the animals were habituated to the apparatus before the experiment, the gradient is fairly level. The upper curve shows restoration of a pronounced gradient when the rats were satiated and the hunger drive thus removed before the runs. The days for hunger and satiation tests were interspersed. Each point on the lower graph represents a mean of 200 time measurements; each point on the upper graph is a mean from 115 measurements.

Again, there is in man an obvious leveling-off of the activity

gradient with practice. If the goal be making a speech or playing a concert, the beginner is known to be markedly aware of a steep gradient of excitement, whereas the seasoned professional has much less excitement and a more level activity gradient. He attributes the difference to a feeling of confidence and assurance in his ability; this feeling, however, does not constitute a genuine explanation but rather it is a fact of experience which itself needs to be explained by reference to habituation.

The Bodily Basis for Knowledge, Foresight, and Purpose. Hull believes that the bodily mechanisms of habit also determine knowledge, foresight, and purpose. His ingenious explanation of purpose is worthy of careful consideration.

The physical world, Hull states, contains many uniform sequences of events which may be symbolized by:

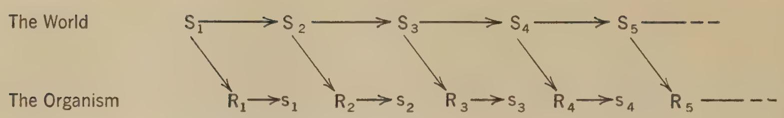
$$\text{The World} \qquad S_1 \longrightarrow S_2 \longrightarrow S_3 \longrightarrow S_4 \longrightarrow S_5 \text{------}$$

Some of these events are cyclic, as the breaking of the waves upon the shore, the sequence of day and night, the swinging of a pendulum; others are aperiodic, as the washing away of a road by a storm, the rolling of a stone down the hill, the growth of a single tree. These sequences in the environment of an organism present uniform sequences of stimulation which evoke series of reactions, thus:

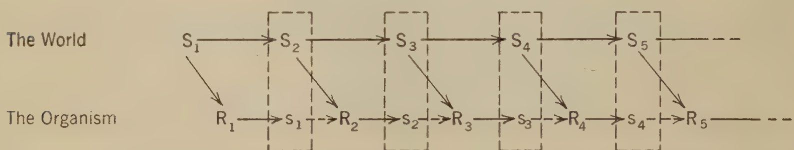
$$\begin{tikzcd}[column sep=small]
\text{The World} & S_1 \arrow[rr] \arrow[dr] & & S_2 \arrow[rr] \arrow[dr] & & S_3 \arrow[rr] \arrow[dr] & & S_4 \arrow[rr] \arrow[dr] & & S_5 \arrow[r, dash] \arrow[dr] & \text{--} \\
\text{The Organism} & & R_1 & & R_2 & & R_3 & & R_4 & & R_5
\end{tikzcd}$$

To be specific, if the series of *Ss* symbolizes the sound waves from a piano in the environment of a boy, the *Rs* stands for his reactions to the sound stimulations.

Now a highly developed organism, possessing receptors located within the muscles, joints, tendons, and visceral organs, is excited by its own reactions through its proprioceptors. Hence there exists an internal sequence of stimulations corresponding to the reaction series, just as the latter in turn corresponds to outer environmental events. Using the symbol *s* to designate the internal stimulations from the organism's own reactions, the picture can next be elaborated as follows:



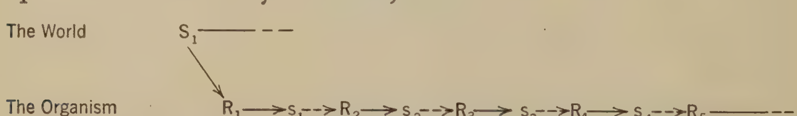
Now if the sequence of reactions is repeated, a habit is formed. The proprioceptive stimulus pattern (s_1) from one reaction comes to call out the response (R_2) associated with it. Through direct conditioning all the responses become linked together into a sequence. In the following figure a dotted rectangle symbolizes the total stimulus complex (environmental and organic) evoking a response. An arrow with a dotted line indicates a newly established and hence a relatively weak associative bond.



Although the sequence of reactions,

$$R_1 \rightarrow R_2 \rightarrow R_3 \rightarrow R_4 \rightarrow R_5 \ldots$$

originally depended upon some uniformity in the physical environment, through a process of conditioning it acquires an independence of the world. If, after learning, the outer sequence begins in the presence of the organism and is interrupted, the series of newly acquired reactions may continue, thus:



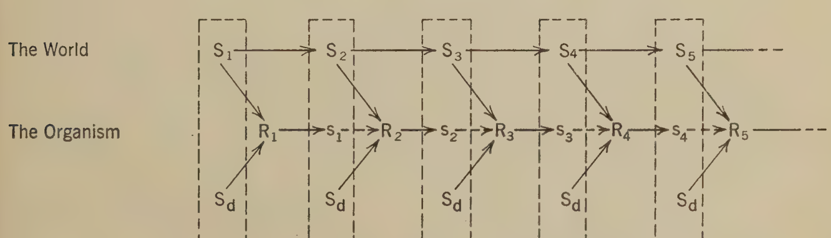
This is increasingly true as the series becomes well learned. If, for example, one hears the letters *A B C D E F*, the further subvocal reactions *G H I* . . . are likely to occur. If a well-known melody is suddenly interrupted, the listener is likely to complete it.

In other words, the world stamps its pattern upon the organism. The redintegrative sequences can run off by themselves independently of any world sequence, once they have gotten a start. It is this process which occurs in serial reactions such as repeating a well-learned verse, or telling an old yarn. It is the same process

which enables us to anticipate the thunder and rain when the lightning flashes. This ability to anticipate impending events has great biological value; organisms possessing it to the highest degree, other things being equal, are the ones most likely to survive.

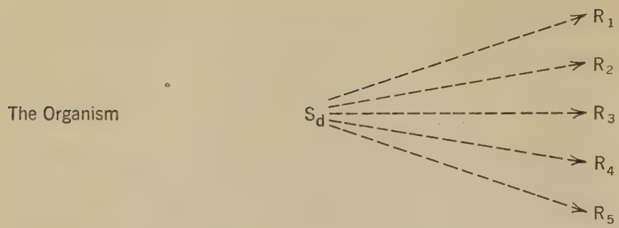
In some habits, such as reciting a poem or typing a certain word, all the reactions have to be made in sequence. In other habits the intermediate reactions are useless or even wasteful. A child, for example, has been taught the multiplication tables in parrot-like fashion. If he wants to know the product of nine and six, he runs through the table of nines up to six, counting on his fingers until he arrives at the result—fifty-four. A reduction in the amplitude and number of these intermediate counting reactions would be advantageous. Actually they tend to drop out with continued learning as do the entrances to blind alleys in a maze. How does this come about?

In situations which give rise to purposive activities there is always a persisting stimulation. If the animal is hungry there is the recurring cramp of the digestive tract. If cold, there is the persisting thermal stimulation from the environment. If puzzled by a problem, there is perhaps a continuous knitting of the brows. If annoyed by a dazzling light, there is the persisting light stimulation on the retina. The persisting stimulus is an essential feature of every drive. For this reason it is symbolized by S_d, and added to the diagram as follows:



The *drive* stimulus is unique in that it becomes the one constant conditioning stimulus to all the reactions in the series, whereas the other stimulus patterns are incessantly changing.

The multiplicity of excitatory tendencies which the drive stimulus evokes can be represented in this way:



If it were possible to measure the strengths of these excitatory tendencies between S_d and the different responses, they would certainly be found to vary.

The goal-gradient hypothesis implies that the reaction near to the goal in space and time (R_5) is more quickly learned than the others (R_4, R_3, etc.). Useless reactions near the goal are, as noted above, the first to drop out in maze learning. Although the explanation for this backward elimination of useless movements is not well understood as yet by anyone, the fact remains that both animals and men learn to go directly to their goals.

Central Preparation and Readiness to Act. Hull's analysis relies in large part upon a relatively simple form of the reaction hypothesis, whereas purposive behavior is dominated by complex motor attitudes or central determinations. These central determinants may utilize varied action systems in expressing their purposes. For example, if it is my purpose to convey to you a given melody which I have heard, I may sing it, whistle it, play it on the piano or violin, perform it on the pedals of a pipe organ, or pound it out on a set of orchestral chimes. Furthermore, I am not dependent upon any particular set or sets of muscular reactions; with a new and unfamiliar instrument I can probably pick out the melody. All this implies that the melody pattern corresponds to some dominant inner determination. The case is similar to that of a rat who learns to run the maze and then threads his way by swimming through the same maze flooded with water. Wholly different muscular reactions are involved, but the same inner determination obviously dominates the rat's behavior in both cases.

The reaction hypothesis, despite its sound foundation in experimental fact, must be reformulated so that it can account adequately for the above facts of purposive behavior. Lewin's doctrine of an inner tension which motivates various acts until finally released,

Koffka's hypothesis of "completion" of certain behavioral requirements to "close" a physiologically "unclosed" system, Köhler's view of configurations in the brain, Raup's theory of complacency, Cannon's expounding of the principle of homeostasis—all these are attempts to solve the problem of purpose which lead beyond a restricted stimulus-response hypothesis. We do not in the least question the facts of stimulation and response, but rather we doubt the complete adequacy of the reaction hypothesis to explain the problem of purposive determination.

Here is an everyday case of purposeful action. Yesterday while reading a psychological article I met the word "ancillary." Being unsure of its precise meaning, I determined to look it up. There was no dictionary at hand, so the matter was dismissed from mind. Today in the office while grading examination papers my eye fell on a desk edition of Webster. With scarcely a pause or a conscious thought I reached for the book, turned to "ancillary," and read the definition carefully.

What happened here? In the first place, meeting an unfamiliar word determined me to find its meaning. The determination could not be carried out on the spot, so it was set aside by more dominant motives. Activities intervened. I was not aware of any tension or persistent drive stimulation relative to a determination to look up this or any other word. The matter did not occur to me again until my eye fell upon the Webster on my desk. A casual glance at the dictionary redintegrated in me a motor set of the previous day, just as the creaking of the back door redintegrated in the cat a neural set which directed her towards the door. The absence of a dictionary yesterday had blocked me; a dictionary was precisely the object wanted. When the familiar book appeared today there was a redintegration of the motor set to find "ancillary," and this was followed automatically by action.

In this instance, I do not believe that any muscular tension persisted from yesterday till today, with eight hours of deep sleep intervening; but I am sure that a casual glance at the dictionary did build up again a motor set. Between yesterday and today a neural readiness to act held over. Holt stresses the point, *i.e.,* that bodily set is the basis of purpose, when he says:

The purpose about to be carried out is already embodied in what we call "motor attitude" of the neuromuscular apparatus; very much as a musical composition is embodied in a phonographic record.

It should be said that Hull's critical analysis of purpose and anticipation on the basis of the reaction hypothesis is not in any sense incompatible with the emphasis we have placed upon central processes. On the contrary, the present stressing of the rôle of central neural organization is a necessary supplement to Hull's doctrines.

Conscious Purpose and Purposive Determination. Every individual is more or less clearly aware of his own purposes. He thinks of future situations and events, describing his purposes in terms which refer to anticipated environments. He imagines himself, for example, in a train, another city, a building, engaged in this or that activity.

The reference to future environments, *i.e.,* to trains, cities, buildings, and so on, distinguishes conscious purpose from purely physiological process. An examination of the living brain does not reveal any consciousness of environmental objects—but only the physical and chemical processes going on within the tissues. If it were possible to expose the brain tissue and observe directly all the changing neural sets and shifting functional patterns during any activity, the conscious reference to past, present, and future environments would not be found there. There would be no trains, cities, buildings, etc.

The trouble is fundamental. Direct observation of processes in the brain presupposes an *objective* point of view, and from this standpoint one might as well try to find the soul in a chunk of putty as to discover conscious purposes in the brain. Only from the *individual* standpoint are conscious purposes directly experienced. From this standpoint they are frequently reported in words, gestures, or other symbols, always in terms which refer to the environment.

It is conceivable that a skillful neurologist, who knew all the facts about an individual's past behavior and brain function, might be able to interpret this individual's neural organization in terms of environmental situations. That is, he might read into the brain patterns their environmental significance or meaning. Granting

this to be possible, the achievement would still be an *interpretation* of brain action in terms of *assumed* environments.

The only direct scientific evidence for the existence of conscious purpose is found in the communications—verbal or gestural—of experiencing individuals. For example, if I determine to take a trip to Chicago and declare this to be my purpose, there has been such a communication of intention. After a declaration of purpose no one thinks it queer for me to prepare the auto and drive to the city.

My subsequent behavior, it may be said, directly reveals the declared intention. That is true, but only the verbal declaration which was made in advance laid bare the details before they happened. Human and animal behavior is shot through and through with goal-seeking and open purposiveness. To account for the purposive character of behavior, psychologists have assumed the existence of determining factors, variously named, as bodily orientations, inner adjustments, sets, postures, neuro-muscular attitudes, and so forth.

Is it necessary to assume anything more than bodily determinants to account for conscious purposes? In addition to *bodily* factors are there also *mental* determinants of purposive activity?

To the author the term "mental" designates a point of view—that of the individual who is consciously aware of his own purposes. Starting from the reports of individuals, the psychologist assumes the existence of relatively stable *mental* determinants in his subjects.

The layman does precisely the same when he assumes that an intention is in his mind, that his mind is made up or determined, that purposes in the mind persist during dreamless sleep as well as during diverse waking activities, that they direct and regulate conduct. This view appears to the author to be entirely sound. To assume a *mental* determinant on the basis of individual conscious experience is just as valid as to assume an inner neural determination on the basis of objectively observed behavior.

In reality the mental and bodily determinants of behavior are identical, both being assumed to explain certain facts of experience. There are not two complete outfits of motivating machinery within the personality, but only one. The study of motivation may be approached from different angles, just as a burning house may be viewed from the outside or inside, from the air, from north, south,

east, or west. But regardless of the standpoint from which motivation is studied, one finds it necessary to assume the existence of regulating and directing determinants of human conduct. A purpose which persists and a neural, or neuromuscular, set are one and the same thing.

Conclusion. Persisting stimulating conditions within the tissues, the environment, or both, bring about increased general activity, which leads to learning. The attainment of a goal, or the completing of a reaction which removes the drive stimulus, restores physiological equilibrium, bringing the drive to a close.

Through a process of learning, animals acquire behavior which leads them to make appropriate and satisfying consummatory responses to environmental conditions. In acquired purposive behavior there is an unlearned, *i.e.*, innate, causal factor which resides in the bodily mechanisms of drive.

When an animal is moving toward a goal object he runs progressively faster as he nears the goal. This speed gradient is associated with increasingly rapid habit formation as the objective is approached. After the process of learning is completed, the animal has acquired a goal orientation. He is *set* towards a definite place or predisposed for a particular kind of final response.

The human individual is conscious of purposes which he successfully or unsuccessfully attempts to carry out in action. To account for them, neural determinations are assumed—preparatory sets, postures, inner adjustments. Some of these determining factors will be scrutinized in the next chapter.

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CHAPTER V

DIRECTION AND REGULATION

"It follows . . . that the typical human motives are wants, needs, annoyances, discomforts, cravings, which it is the effect of activity to change or eliminate."

—H. L. Hollingworth

The study of motivation includes the investigation of behavior from the standpoint of energetics, which was dealt with in Chapter II; also it covers the investigation of those factors which regulate and direct behavior, such as purposes, goal orientations, desires. The aim of the present chapter is to consider some of the basic factors which direct and regulate behavior.

SPECIFIC DETERMINATIONS

Under the heading "specific determinations" we consider those bodily postures, determining sets, and inner adjustments which limit behavior to fairly precise and definite channels.

Bodily Postures. Everyone has observed in animals and man the bodily postures which are preparatory to some specific action. A cat in normal surroundings may be observed at times to crouch as if prepared to spring upon a mouse. The cat for the time is motionless save for slight shifts of position, quivering muscles, and eye movements which follow some object. The entire body of the animal is *set* for action, prepared to spring to a given spot.

With man a corresponding illustration is the runner who toes the line, crouches, and maintains an alert posture while awaiting the sound of a gun. His neuromuscular machinery is integrated temporarily; he is *set* for the race, as we ordinarily say. He is predisposed to start, and when the "Bang" comes no time is lost in getting under way; he reacts immediately and carries on with vigorous activity.

Darwin has reproduced the picture of a small dog watching a cat on a table (Fig. 47). The dog is poised with the front leg slightly

lifted, the head tilted a bit to one side, the ears raised, as if the whole organism were ready and waiting to move on the slightest provocation. This is the bodily posture commonly called expectant attention. Such postures are frequently observed in the constant onflow of animal behavior.

Fig. 47. Bodily Posture of a Small Dog Watching a Cat on a Table. (*After Darwin.*)

From an illustration of Szymanski showing twenty-two postures in the frog, three samples are reproduced in Fig. 48; these represent sleeping and alert bodily attitudes. Szymanski studied the bodily postures of different animals and classified them under three headings: sleeping, resting, and preparatory. The last includes all the attitudes of approach and escape.

Bodily postures are seemingly static. In the continuous flow of behavior the organism pauses a brief moment to look, listen, sniff, or to prepare to run, spring, dive. For the time an apparently static posture appears.

Fig. 48. Typical Postures of the Tree-Frog. (*After Szymanski.*)

Upper left, sleeping; other two, preparatory postures.

Physiologically, however, the static condition depends upon a constant expenditure of energy. If anyone should be inclined to doubt this proposition, let him pose for a minute or two as a statue with outstretched arms, or let him attempt an interpretive dance in which postures have to be steadily maintained. A bodily attitude is merely a transitional phase in a series of movements, part of the current of activity.

A bodily attitude from the physiological point of view can be described in terms of muscle tonus and of the sensory, neural, and chemical processes that support it. To a large extent, bodily posture is reflexly controlled. A decerebrate cat is able to stand reflexly, supporting its weight against

the pull of gravity. If the position of the head be changed while the animal is standing, the entire body adjusts itself to the head position. For example, if one raises the cat's head, the total attitude becomes that of a cat looking upward. In this instance the explanation lies in the fact that receptors within the labyrinth of the inner ear are connected to the neuromuscular structures which regulate posture. Also receptors located in the muscles, tendons, joints, and related tissues start excitations which pass through the spinal centers, playing an important part in the regulation of static equilibrium.

Posture is to a high degree, though not exclusively, controlled by environmental stimulations. Consider, for example, what happens when a bright light appears at the edge of one's visual field. The eyes move so as to fixate the source, and along with eye movements the head adjusts itself in such a way as to permit the eyes to assume their normal forward position in their orbits relative to the head. Then the excitations from receptors in the neck muscles reflexly change the tonus of trunk and limbs until finally the whole body is oriented towards the bright point of light. The process is a smooth, continuous, integrated adjustment of bodily posture relative to the position of a stimulus object.

Postures also are dependent upon inner stimulations. The physician learns to recognize the characteristic attitudes of headache, appendicitis, chest pain, fatigue, well-being, and so on. Everyone is familiar with the outward expressions of grief, thoughtfulness, anxiety, which often lack a specific orientation to environmental objects.

The study of bodily posture is of basic importance to the psychologist interested in the determination of behavior. A posture is an overt adjustment to the gravitational field, to a light or visible object, a sound, a prick or pressure, or to a complex meaningful situation. It also is an outward expression of the internal bodily state. The total attitude which is regulated both by outer and inner stimulus conditions helps, in turn, to regulate the course of behavior by predisposing the organism to react in a specific way.

The study of posture and of attention are intimately related fields. With man as well as animal a shift of primary attention is essentially a shift of bodily orientation to environmental conditions. The small dog shown in Fig. 47, for example, has assumed the posture of

attending to a visible object. The well-known conditions of primary attention—intense lights, sounds, sudden changes in the environmental field, moving objects, etc.—are certainly conditions which induce observant and preparatory postures.

Fearing writes: "The intimate relationship between posture and tonus, and the connection between the latter and the psychical process of attention, seem to indicate the possibility of renewed attack on the problem of attention. All the facts seem to point to an intimate connection between attention and the tonic state of skeletal muscle; it has been suggested that tonus *is* attention expressed in neuro-muscular terms. The study of posture—static equilibrium—offers an opportunity to experimentally analyze the relationship between attention and neuro-muscular functioning."

Internal Determinations in the Delayed Reaction. In a well-known experiment by Hunter, the ability of certain animals to delay their reaction was tested.

One form of the apparatus is diagrammed in Fig. 49. The subject was first trained to go from a release-box (*R*) to any one of three boxes which might be indicated by a light (*L,L,L*). If the correct choice was made, the animal was allowed to escape through the door (*D,D,D*) and find food. If the wrong choice was made, he found the exit closed. In some of the experiments a mild electric shock was used as additional punishment for wrong choices.

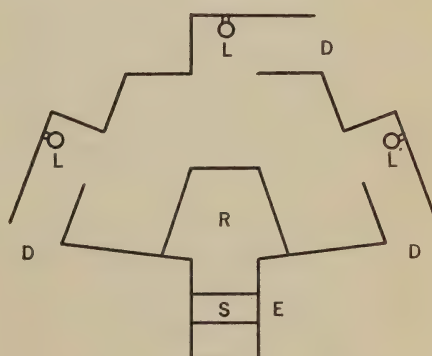


FIG. 49. GROUND PLAN OF APPARATUS FOR STUDY OF DELAYED REACTION. (*This form was used by Hunter with raccoons.*)

R, release box designed to be raised by cords over pulleys; *E*, position of experimenter; *D,D,D*, sliding doors located at these positions; *L,L,L*, light boxes; *S*, switchboard for experimenter covering part of entrance-box, the remainder being covered by pasteboard.

After the training period, a light quickly induced an orientation of the animal toward a given position, and this orientation determined the path followed when the animal was released. The release-box was arranged so that the subject could look out but not escape until the experimenter released him. In a typical experiment

a light was flashed and then extinguished. The subject was forced to delay for a time before his response was tested.

Hunter found that rats could learn to maintain a bodily orientation towards the position of the extinguished light, this orientation later determining the course they followed when released. With dogs the determining cue was the position of the head rather than the orientation of the total body. The pointing of the head towards the position of the light and the maintaining of this posture made possible the delay in reaction.

Raccoons, however, appeared to be less dependent than the other animals upon gross motor adjustments. They sometimes went to the correct box despite an incompatible bodily orientation at the moment of release, and sometimes to the wrong box despite a correct orientation. In a word, the behavior of the raccoons appeared to be dependent upon some intraorganic cue not outwardly shown in bodily posture.

Since the pioneer work of Hunter a good many studies have been made upon the delayed reaction. McAllister has shown that rats can delay reactions without any gross bodily orientation. He set out to answer the question: "What does the rat do when placed in a situation in which it cannot react on the basis of gross bodily orientation?"

To this end his animals were kept in motion during the period of delay, and could not, therefore, maintain an overt posture. Under these conditions the maximal delay was 11.5 seconds (median value), which is shorter than Hunter's estimate for rats, when posture was frequently relied upon.

McAllister's experiment shows that with rats a delay period may be bridged by some sort of intraorganic cue which persists during delay, or else a cue which is reinstated after a period of delay. Apparently, then, rats and other animals can delay their response to a signal, either by maintaining an overt bodily posture, or by utilizing an intraorganic cue.

Hunter found, working with small children, that they could delay responses without the necessity of maintaining overt postures. More recently Skalet studied the delayed reactions of sixty preschool children. His method was to conceal an object and to study the ability of children to find it after relatively long periods of

time. The maximum delays obtained by Skalet ranged from one to thirty-four days. The older children and those with the higher mental ages tended to remember longer than the younger ones and those with less intelligence.

It is clear that in long-delayed responses the problem is fundamentally one of memory. A squirrel, for example, buries a nut and much later returns to dig it up. Probably he has little if any hunger motivation at the time of burying the nut, and is definitely hungry when he digs it up. Granting this difference in motivation, there is still a holding over of the memory trace. If an animal reacts correctly after a long period of delay, there must be some internal neural organization that persists as a substitute for overt bodily orientation.

What is the probable nature of this internal determination which directs the behavior of an organism to a given spot, and leads to a specific type of reaction? The question cannot be answered fully as yet, but the following experiments of the writer and collaborators throw some light upon the matter.

Experiments upon Organic Set (Specific Determination). Psychologists have used the term "set" in a general way to include preparatory adjustments, neural dispositions, bodily postures, determining tendencies, attitudes, and other directing or limiting factors.

In the experiments described below, the term "set" is used to designate a temporary preparation of the organism, established either by verbal instructions or by non-verbal environmental conditions, which determines the pattern of activity as well as the configuration of individual conscious experience. The preparatory adjustment exists in the nervous system and sometimes in the muscles as well; for this reason it is called "organic" set.

The general method of the first series of experiments was to seat the subject before a board containing ten miniature electric lamps arranged in a circle. The experimenter flashed these lamps one at a time. Every presentation contained either two, three, four, five, six, seven, or eight flashes. The subject was instructed to note carefully the order and position of the lights as they appeared, and at the close of the series immediately to point to the places where the lights had flashed.

A pattern of lights established a temporary set in the subject which immediately determined his response. The various questions raised

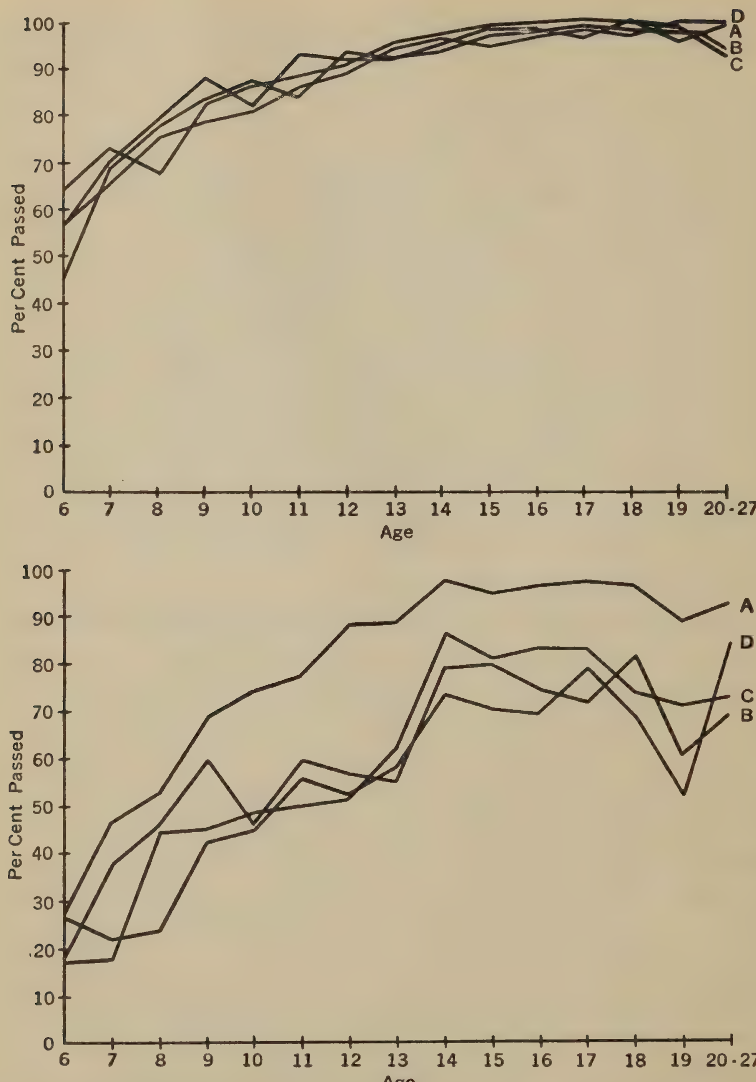


FIG. 50. RELATION BETWEEN AGE AND THE CAPACITY TO ASSUME A TEMPORARY SET. (*Data obtained by D. A. Rothschild.*)

The base line shows the ages of children taking the test; the vertical gives the percentage passing. The upper curve presents results obtained when the child pointed, in order, to the positions of three consecutive lights; the lower curve, results when four lights were used.

in the investigation and their experimental answers will be considered one by one.

1. *How does the ability of the subject to become temporarily set vary with age?*

To answer this question a carefully prepared test was given to grammar-school and high-school children. There were four three-light patterns in the test, designated *A, B, C, D*. These were presented to 822 subjects distributed among the different age groups. The result for the test with three lights is shown graphically in the upper curve of Fig. 50. The percentage of each age group passing the test, *i.e.,* pointing correctly to the three successive positions, is indicated.

The result with four-light patterns under the same conditions is shown in the lower curve of the figure. With four lights the task is more difficult for all tests. Curve *A* is higher at every age than curves *B, C, D*. The explanation of this lies in the fact that the four points of the pattern formed the familiar and symmetrical letter *Z*. All the patterns were selected by chance, and the above unsought result shows that the spatial configuration of the pattern was an important factor making for ease or difficulty of reproduction.

Somewhere between ages fourteen and sixteen the performance with three lights reaches approximately 100 per cent correct. This is also true with tests of four lights. Again, with tests containing five, six, or seven flashes the capacity to become temporarily set increases up to fourteen or sixteen years, appearing not to vary after these ages. This capacity, therefore, is a good index of mental growth, and it has rightly been used in test batteries which are based upon the principle of growth.

2. *How does the ability of the subject to become temporarily set vary with the amount of practice?*

To answer this question a group of six-year-old children were given practice on the three- and the four-light patterns. Every child had twenty trials per period, these trials consisting of ten three-light and ten four-light patterns, presented in alternation. No pattern appeared twice in the experiment. Eleven children practiced twice a week for twenty-five practice periods. The result of the practice is shown in Fig. 51. The upper curve gives the total number of correct reproductions for three-light patterns and the lower curve for four-light patterns.

The curves show a well-marked practice effect for both the three- and the four-light patterns. Tests with four lights show the effect of practice somewhat more markedly than tests with three lights, but the difference may be a statistical artifact inasmuch as the three-light patterns were easy and the scores throughout were near to the 100 per cent limit. Overlearning, which undoubtedly existed with the three-light patterns, could not be shown under the conditions of the experiment.

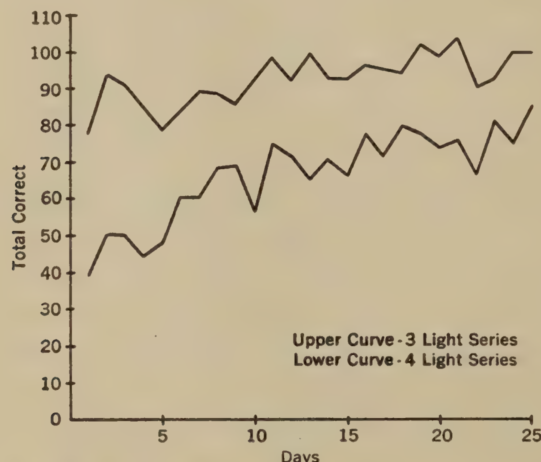


FIG. 51. RELATION BETWEEN PRACTICE AND THE CAPACITY TO ASSUME A TEMPORARY SET. (*Data obtained by R. H. Gundlach.*)

Eleven children practiced twenty-five periods upon the reproduction of three- and four-light patterns, the points of which were flashed successively. The score is the number correct.

3. *How does the ability of the subject to become temporarily set vary with the speed of presenting a task?*

To study this question four adults were given tests with five-light patterns. Fifty patterns were presented at each of ten different speeds, the total presentation times for the five lights being: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0 seconds. The lights of a pattern followed each other with no lapse of time between them, so the duration of a single flash was actually one-fifth of the above presentation times. Every subject received fifty trials with each speed of presentation. The different speeds were used in rotation so as to equalize practice with them.

The number of failures to reproduce the patterns correctly at dif-

ferent speeds of presentation is given below. The figures are totals for all four subjects:

Total Presentation Time	Errors
0.5	159
1.0	100
1.5	86
2.0	78
2.5	86
3.0	69
3.5	61
4.0	51
4.5	46
5.0	51

The figures in general show that the faster the speed of presentation the more frequent the erroneous responses, and conversely, the slower the speed the less frequent the errors. It takes time to get set for action. The speed of presenting a task is therefore an important factor in the process of temporary setting.

4. *What do the subjects experience in carrying out the task?*

During the above experiments verbal comments of the subjects were recorded. Also special experiments were made with a number of subjects who were highly skilled in psychological observation; their reports were taken down fully.

The verbal comments indicate that the points of light become grouped into triangles, squares, and other visual configurations. Sometimes imaginary lines are seen joining the points. In some way the separate units are bound together, organized, "clinched" into patterns of light points. This integration of the flashes is also experienced kinesthetically. The movement of eyes, head, trunk, and arms in following the sequence of lights is sensed kinesthetically, and sometimes a long series is broken up into parts both visually and kinesthetically.

The experience varies with the speed of presentation. At fast speeds (0.1 to 0.3 second per single flash) there is usually a single fixation of the eyes in the center of the board while the lights are seen in indirect vision with a "spread of attention." The after-image of immediate memory is said by some to be clearer with the fast than with the slow speeds of presentation. At slower speeds there are, instead, successive fixations of the flashing lights.

Various secondary cues are made use of, according to the subjects' statements. Some of these cues are: the noting of geometrical relations in inner speech, as "above," "parallel," "skip one," etc.; rhythmical movements of the body and verbal rhythms as "there . . . there . . . there . . ."; incipient pointing movements during the presentation; mental reviewing of the sequence, etc. These secondary aids play relatively a greater rôle with the slower speeds of presentation.

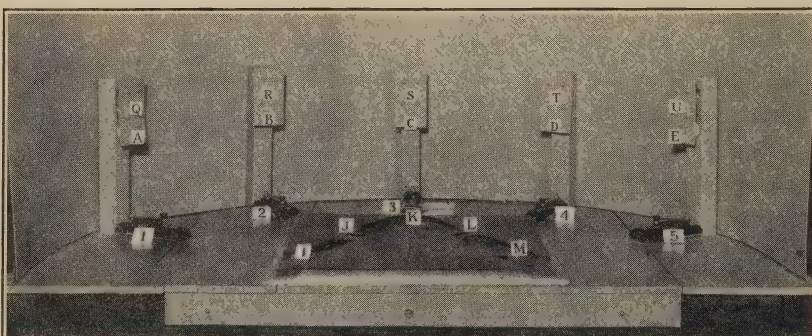


PLATE VI. APPARATUS USED TO STUDY PERIPHERAL AND CENTRAL FACTORS IN ORGANIC SET. (*Compton.*)

Five miniature electric lamps are located at *A, B, C, D, E.* Above them and concealed from view are five telephone receivers, *Q, R, S, T, U.* The auditory presentation is the humming sound produced by a 60-cycle current, carried through these receivers. On the surface of the table is a felt pad shaped to accommodate the relaxed forearms of the seated subject. Through this pad five holes are cut at *I, J, K, L, M.* Beneath each hole is a piano action, controlled by an electromagnet, which is capable of raising a sharpened metal point to give a pain-contact to the skin. The apparatus gives five spatially distinct positions, to the eye, the ear, and the skin. The keys for signaling all patterns are shown at 1, 2, 3, 4, 5.

5. *Does the ability of a subject to become temporarily set depend primarily upon the sense department in which a spatial pattern is presented, or is it primarily determined by some adjustment of neural mechanisms within the brain?*

To study the problem an apparatus was devised to present sequences of point stimulations to the eye, the ear, and the skin. The lights, sounds, and touches were of equal duration and of medium intensity. Intensities near the lower limen and intensities so great as to induce unpleasantness were avoided. Every point stimulation came from a definite position in space, the points being separated

far enough to insure that errors in their localization and discrimination could not easily exist.

The apparatus, constructed by R. K. Compton, is shown in Plate VI. With this apparatus, patterns of six successive points were presented to fifty adult subjects. Each point presentation lasted 0.7 second, and there was zero interval between them.

Twenty-eight carefully selected space-time patterns were presented in each of the following modes:

1. All points visual (V).
2. All points auditory (A).
3. All points tactual (T).
4. Visual and auditory points alternating (VA).
5. Visual and tactual points alternating (VT).
6. Auditory and tactual points alternating (AT).
7. Visual, auditory, tactual rotating (VAT).

In planning the experiment, practice and pattern difficulty were equally distributed among the modes and thus balanced out.

The subject was instructed as follows:

The apparatus in front of you will present a pattern of six lights, sounds, or touches. Sometimes all six will be lights, sometimes all will be sounds, sometimes all will be touches, sometimes they will be mixed.

A buzzer will give two seconds' warning before the presentation.

Attend closely to the presentations as they come, especially to the *position* and *order*.

Count out loud as they come, saying—1, 2, 3, 4, 5, 6.

You are instructed to reproduce immediately the *position* and *order* of the presentations by pressing the signal keys. Use the right hand in pressing the keys.

Do as well as you can and don't worry if you miss.

The experimenter was across the room from the subject. By means of a control panel he plugged in the previously selected patterns of points, and a synchronous motor timed the presentation. When the subject pressed the signal keys, lamps on the control panel flashed in such a way that errors and omissions were indicated. Every trial was scored merely as right or wrong.

The results show differences dependent upon the mode of sensory presentation. The average number of correct reproductions of the twenty-eight patterns for the whole group of fifty adult subjects is given below.

Mode	Average Number Correct	S.D.
A	16.22	5.14
V	15.86	5.46
VA	14.96	5.15
T	10.70	4.36
AT	10.42	5.52
VAT	10.40	5.67
VT	9.24	5.55

From these figures the following generalizations can be made. First, the slight superiority in the effectiveness of auditory over the visual mode is not statistically significant. Second, auditory and visual modes of presentation are both much more effective than tactual, judging from the average scores of the subjects. Third, all modes which contain tactual stimulations give results inferior to those which lack touch points. Fourth, pure modes (A, V, T) are superior to mixed modes (VA, AT, VAT, VT), although the differences are not all statistically significant. Auditory and visual modes of presentation are superior to the combined visual-auditory mode, and the tactual is superior to all mixed modes containing touch.

The average scores given above are arbitrary in the sense that they depend upon the amount of practice given to the subjects. Practice tends to increase all scores; but there is a strong indication that it does so selectively, increasing most markedly the lowest ones. Practice thus reduces the differences in score, tending to produce uniformity in performance with the various modes.

A more significant result is obtained when we examine the data to find out whether the subjects who make high scores with one mode of presentation also make high scores with other modes. The answer to this question is given by coefficients of correlation among the scores for different modalities. These values, based upon the total group, are presented in the following table.

COEFFICIENTS OF CORRELATION BETWEEN SCORES WITH DIFFERENT MODES OF PRESENTATION

	A	V	VA	T	AT	VAT
V	0.90					
VA	0.88	0.86				
T	0.88	0.87	0.81			
AT	0.78	0.80	0.76	0.81		
VAT	0.80	0.76	0.79	0.79	0.89	
VT	0.81	0.76	0.78	0.82	0.87	0.92

The figures are consistently high and indicate that a general ability to assume a temporary set does exist, quite independently of the particular mode of sensory presentation. When corrected for attenuation the coefficients approximate 1.00.

Another important result is the discovery that the difficulty in getting set to reproduce a pattern depends more upon the space and time relations of the pattern itself than upon the mode of sensory presentation. Accordingly, if a pattern is difficult in one mode, it is likely to be difficult in all other modes.

This principle is clearly illustrated by the findings in a special series of tests in which the lamps were transferred from the original positions (*A, B, C, D, E,* Plate VI) to the table right next to the tactual points (*I, J, K, L, M*). With this change in the apparatus a series was given which contained only visual, tactual, and visual-tactual presentations. After the experiment the scores for the patterns were arranged in an order of difficulty for each of the three modes. Rank-order coefficients of correlations were computed, and found to be:

$$r_{vt} = 0.96$$
$$r_{v(vt)} = 0.81$$
$$r_{t(vt)} = 0.85$$

These high coefficients show that if a pattern is difficult in one modality it is also difficult in the others. Ease or difficulty, therefore, varies with the space-time relationships in the pattern.

The patterns which were frequently missed have been analyzed to determine the sources of error. Verbal reports also throw light

upon the nature of the difficulties. Some of the factors which make a pattern difficult are: the complexity of the geometrical design made by the successive points; the spatial proximity of successive points; the number of crossings of the subjective lines in a pattern; the direction of the bodily movement required to follow the successive points—left to right, generally speaking, being easier than right to left—and the number of reversals of such movements; the temporal location of an intricacy, *i.e.,* whether at the start, middle, or end of the pattern sequence.

The experiment as a whole demonstrates the importance of the part played by central neural factors in the establishment of a temporary set, in contrast to peripheral processes. Differences dependent upon the mode of presentation do exist to an appreciable extent, and they vary with the sensory modality itself (whether pure or mixed), with practice in the mode, and probably also with such variable factors as the intensity, quality, and spatial distinctness of the point presentations. But *getting set* is primarily a central process.

Additional Examples of Specific Determination. In all the various fields of experimental psychology, evidence can be found to support the view that a specific determination to observe, or otherwise to react, definitely regulates the pattern of individual experience and behavior. Turn to the field of perception for a self-evident illustration. The illusions of reversible perspective, and other ambiguous figures such as those of Schumann (see Fig. 6, p. 35), show how one's *set* elicits a configuration of experience. A specific assumption, whether made by the individual himself or commanded by someone else, definitely determines the perspective, pattern, or meaning of the figure. Again, in the sphere of associative learning, it is well known that the instructions to the subject influence his manner of memorizing and his subsequent recall. Suppose, for example, that an individual be instructed to learn in sequence the following pairs of nonsense syllables:

tiv-jix
nuv-ral
zof-dep

After a number of repetitions the subject can reproduce "jix" when "tiv" is presented, or "ral" when "nuv" is given. But if he be asked to reproduce the next syllable after "jix" or after "ral," there is less

likelihood that he will make the correct associations. The *set* to learn the pairs in a particular way is a condition of memorizing and of subsequent recall. Likewise, in controlled recall the instruction "think of names of cities" or "think of names of flowers" definitely regulates the chain of associations produced.

Once more, in studies upon reaction, the preparatory *set* of a subject determines his promptness of response. If, for example, one be prepared by printed instructions to move as quickly as possible, the reaction time is shorter than when prepared to observe clearly. Finally, in the field of attention, if two stimulations come simultaneously, the one for which the individual is prepared produces its conscious effect first. Titchener stated this principle, as a law of attention, thus: "The stimulus for which we are predisposed requires less time than a like stimulus, for which we are unprepared, to produce its full conscious effect." The principle was demonstrated in the classical experiment of Wundt upon the visual-auditory complication.*

In all the above cases and in innumerable similar ones which can readily be found in the different fields of experimental psychology, there is some neural adjustment which underlies and regulates the subject's behavior as well as the pattern or structure of his conscious experience.

In daily life further illustrations of the same principle abound. The housewife expecting the arrival of a guest is alert for the doorbell and gets to the door quickly when it rings. The mother, constantly *set* for her baby's cry, hears it sooner than does the father who actually has a keener ear. The hostess is more vividly aware of a spot on the tablecloth or a fly buzzing around the dining room than are her guests. The teacher expects to find his students occupying particular seats in the class room and may fail to recognize them in other environments. All such cases bear witness to the existence of a specific *priming* or *readiness* within the individual.

THE SO-CALLED "WILL" FACTOR

In the present connection something should be said about the so-called factor of "will." We have pictured motivating factors as act-

* A complication is a pattern of conscious experience in which presentations to different sense departments are bound together in some sort of unity, as with the moving and sounding metronome pendulum.

ing automatically and mechanically, just as physical factors determine causally the movements of inanimate bodies. We have rejected the conceptions of *libido*, mental energy, psychic force, in favor of a purely physical doctrine of energetics. This stand does not free us from the obligation of facing squarely the problem of will, and of making a direct positive attack upon it. We begin with *will* as a factor in learning.

The "Will to Learn." Well-known educators of the past have written such phrases as the following: "The reason we are inefficient is that we don't really care enough about improvement"; "The will to learn is essential to learning"; "Intense effort applied to details is a condition of success"; "Supreme effort develops." Psychologists have recognized the same principle. In one of the classical studies upon memory, Ebert and Meumann wrote that the will to strive toward perfection in a given exercise is essential to progress.*

The mere passive repetition of nonsense syllables is a very uneconomical method of memorizing them, as Poppelreuter has shown. He stated that, when subjects were presented with a series of nonsense syllables to be learned, their behavior varied markedly with the experimental instruction. When they were asked merely "to read," with a single exception Poppelreuter's subjects read in a low voice with careless articulation of the syllables; they interpolated remarks, laughed in amusement, etc.; but when the same subjects were instructed "to learn" there was a sudden and complete change of behavior. Facial expressions became tense, the syllables were read with a rhythmical accent, and the subject's bodily postures were clearly adjusted toward the apparatus. Poppelreuter was surprised to find that after a series of fifty readings he himself had learned relatively few of a list of twelve nonsense syllables, whereas ordinarily he could learn such a list in about twelve readings when he willed to do so.

In a well-known experiment, Book and Norvell studied experimentally the "will to learn." In the hope of discovering the specific *will* factor it will be worth our while to study this experiment in detail.

* "Es ist daher der Wille oder der Entschlusz, eine Vervollkommung zu erreichen, ein absolut notwendiges Element des Übungsfortschritts."—E. Ebert and E. Meumann.

For subjects these investigators employed a group of college juniors and seniors (forty-eight men and seventy-six women), assigning them four simple tasks. The tasks were as follows: (1) Making the letter *a* as accurately and rapidly as possible—a muscular feat using a habit system which was previously well learned. (2) Crossing out certain letters in lists of disconnected Spanish words—a motor process depending upon visual discrimination. (3) Translating the digits of five-place numbers into letters according to a key which was printed at the top of the page. (4) Multiplying two-place numbers. With each subject the periods of rest and practice upon these tasks were systematically controlled.

Two types of motivation were employed which the experimenters designated as *stimulus* and *control*. For both types the subjects were instructed to do their best with the tasks assigned, but the *stimulus* groups received additional incentives, as follows: (1) Each subject was required to count his score after every practice period and to keep the result before him while working. Thus the subjects were kept vividly aware of their improvement or deterioration in performance; they worked with complete knowledge of results. (2) The experimenter tried to make each subject believe that he really *could* improve from trial to trial, and urged him to do so. When an individual failed to increase his previous score he was given personal assurance that improvement could be made, and told to make up his mind to do better. (3) The subjects were further instructed to study their scores, keeping alert for anything which might facilitate learning as well as trying to avoid whatever hindered it. (4) At times they were told emphatically that they really *ought* to make more improvement than they had shown.

Thus, although both groups were instructed to do their best, the *stimulus* group had a knowledge of results, additional encouragement to study scores and methods, and an exhortation to improve their work.

One important feature of the investigation was the sudden reversal of *stimulus* and *control* conditions after the first two-thirds of the experiment. The following plan summarizes the procedure:

Task	Section	First $\frac{2}{3}$	Last $\frac{1}{3}$
1. Drawing letter *a*	I	Control	Stimulus
	II	Stimulus	Control
2. Cancellation	I	Stimulus	Control
	II	Control	Stimulus
3. Substitution	I	Control	Stimulus
	II	Stimulus	Control
4. Multiplication	I	Stimulus	Control
	II	Control	Stimulus

When the motivating conditions were suddenly reversed each member of the *control* groups was given a record sheet showing the best score he had made in all his previous practice periods. He was told that this could be surpassed on almost every trial, and then urged to exceed the score as much as possible. In other words, the *control* group was given all the additional motivation previously operative with the *stimulus* groups. At the same time *stimulus* groups were treated just like the previous *controls.* Knowledge of results was withheld; they were told to disregard scores and improvement. They were asked so far as possible to banish all thought and desire for improvement as such from their minds.

There is obviously a question as to how far the desire for improvement and the interest in scores can be suddenly banished at the experimenter's request. Some subjects said that they could not help being interested in improvement during the last third of the experiment (fifteen practice periods), but others said that they successfully banished all thought of improvement. In view of this difficulty with the procedure one is not justified in assuming that the control group for the last third of the experiment is psychologically equivalent to the control of the first two thirds.

But be that as it may, the results for all tasks and groups point with great consistency to the same general conclusion. A single curve, typical of the others, is reproduced in Fig. 52. This curve shows that during the first two-thirds of the experiment both groups gained, but that the *stimulus* group had a decided and constantly increasing advantage. When the motivating conditions were reversed the original *control* (now the new *stimulus* group) made a marked increase in score; the other group exhibited a corresponding decline.

In general, all *stimulus* sections made more rapid and continuous

gains than did the *controls*. This was true both for the total group scores and for all individual records; it was true when relative as well as absolute gains were used. All *control* groups began to make marked improvement when they were converted into *stimulus* groups, and the added incentives also brought increased accuracy of performance (pp. 23-24).

Individuals with the highest initial ability in the different tests made relatively the greatest improvement with special motivation,

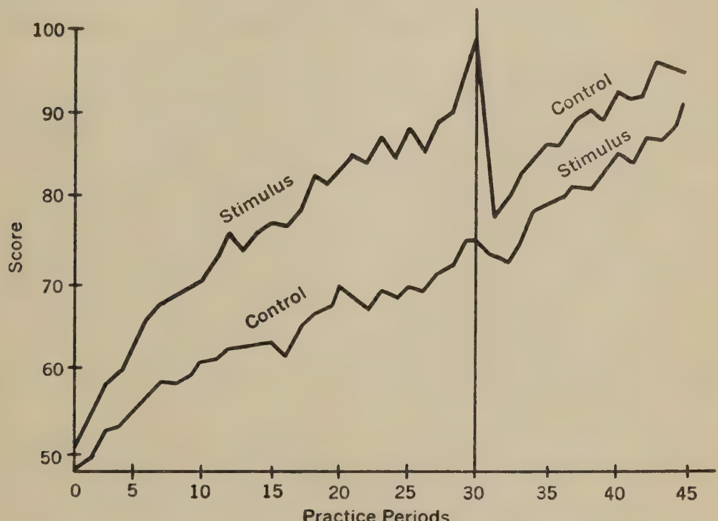


Fig. 52. Learning Curves for Male Subjects with Cancellation Task. (Experiment 2, Sections I and II) under different motivating conditions. (*After Book and Norvell.*)

The score is the number of letters cancelled in sixty seconds.

and when the subjects were submitted to control motivation the individuals with lowest initial ability made on the whole the greatest gains.

In discussing how a "will to learn" may best be aroused in the subject, Book and Norvell make the following practical suggestions:

1. Demonstrate to the learner by figures and facts that desire for improvement is a condition of advancement.

2. Make the learner feel that it is worth while to exert an effort, and that if he does, he will be rewarded by success.

3. Have a reliable method of measuring progress.

4. Keep the learner succeeding so that he may be assured that he has not yet reached the limit of performance.

5. Show that others have improved and developed beyond the learner or, when needed, that others have failed for a time.

Some fail because they do not care about improvement; others, because they need specific help and direction as to how to work. Eagerness to improve without guidance is useless; guidance without expenditure of energy is futile. In the words of the experimenter: "Better methods, better directed learning, more zeal, actual interest or motivation and a firm belief in the possibility of success sum it all up."

The foregoing study is pedagogically important because it demonstrates clearly the rôle of motivation in learning; but psychologically its significance is less clear. In this experiment at least the following factors of motivation can be readily recognized in the so-called "will to learn": (1) knowledge of results combined with critical study of scores by the subject; (2) self-competition and rivalry (which doubtless resulted from the emphasis upon scores); (3) desire for improvement and favorable attitude toward the experimental tasks; (4) encouragement and praise. Every one of these motivating factors individually is known to raise the level of activity. The phrase "will to learn" is of doubtful psychological value when it is applied collectively to such a diverse group of motivating conditions; used in this sense it does not and cannot designate any single and clearly defined *will* factor. Furthermore, the factors obviously included within the "will to learn" are themselves complex and in need of further analysis.

"Will" ***versus*** **Fatigue.** If there is a true "will" factor in the nexus of motives, it has yet to be found. The unsophisticated is certain that sheer *will power* keeps him going in the face of obstacles and fatigue. The transatlantic flight of a Lindbergh, the polar explorations of a Byrd, the many foot-races, fights, and struggles which occur in warfare—all bear witness to the fact that "will" dominates human behavior despite great odds.

While the above sentences are being written there is going on in a California resort a so-called walkathon, that is, an endurance contest in walking. Some contestants are walking the floor alone; others walk in pairs, a man steadying the girl while she sleeps and she

steadying him while he sleeps. The contestants are allowed brief hourly intermissions, but for fifty-one days now these persistent walkers have been constantly trudging along to win the thousand-dollar prize. As the contest continues some fall down exhausted and are eliminated; others in the daily sprints drop from sheer exhaustion, some passing into an hysterical condition as they are eliminated. All are strongly determined to keep on walking around and around the floor. Here, indeed, is *will* in the sense of fixed determination.

The following experiment by Whiting and English purports to show how "attitude" or "will" may counteract the effects of fatigue. The experimenters gave a series of tests to sixteen undergraduates at Wellesley College, first in the morning (8:30 A.M.) and again in the afternoon (4:30 P.M.). The battery included tests for:

1. Accuracy of physical work—tested by the reproduction by arm movement of a given length moved.
2. Accuracy of mental work—tested by the division of a line into halves or thirds by the eye.
3. Speed of mental work—measured by an addition test.
4. Difficulty of physical work—determined by Whipple steadiness test.
5. Difficulty of mental work—measured by multiplication problems of increasing difficulty presented successively.

Whiting and English expected to find the afternoon performance on a lower level of efficiency than the morning one owing to the factor of fatigue, but actually no significant difference was found in the test scores. This fact the experimenters explained by assuming that the "attitude" of the subjects obscured the fatigue effect:

> The attempt to make a good record is certainly a very constant factor in these tests; the subjects exhibited great interest in their records as well as in the records of their fellows. They knew that the experiments dealt with fatigue, and there were frequent indications that knowing themselves to be fatigued, they threw themselves into the game with increased energy. Such spurts are familiar factors in all efficiency measurements; they can only be eliminated by prolonging the tests beyond the possibility of spurting.

The above quotation clearly suggests that motivating factors which other investigators have called "knowledge of results,"

"rivalry," "aim or goal," "will to succeed" were present in the "attitude" which counteracted fatigue. Together they comprise a favorable adjustment toward the work.

In view of the first experimental result, a second project was planned to test the hypothesis that the attitude of the subjects obscured the fatigue effects. In this experiment four subjects worked without intermission for ninety minutes on a battery of eight motor and mental tests. During the first forty-five minutes the tests were taken in a prearranged order, and during the last forty-five minutes the order was reversed.

No one of the subjects showed a real loss in the second work period as compared with the first, except in the speed-of-movement test. Despite the absence of an appreciable work decrement the subjects all reported a marked feeling of fatigue.

To account for the result a distinction was drawn between "exhaustion" and "fatigue."

Considered as a subjective phenomenon, fatigue is seen to be a feeling of a complex sort closely akin to the appetites. Its strong emotional coloring, the unanalyzable complex of visceral and organic sensations, the internal stimulus, and especially the direct and obvious relation to motor activity all suggest classification as an emotional appetite. As such, fatigue functions as a conscious (and negative) motive for action. Thus where exhaustion affects primarily the mechanism by which work is accomplished, fatigue tends to withdraw or reduce the motive power or drive. Or rather, the effect of fatigue is to raise the threshold at which a work motive may be effective, but does not lower the efficiency of the work, granted the adequacy of the positive motive.

The experiment points to the existence of two motivating factors or factor groups which operated side by side: (1) the determination or attitude of the subject, described as the *will* to do well on the tests, and (2) fatigue. The hypothesis is reasonable that the increments from the first offset the decrements of the second. This hypothesis at least fits the belief of everyday life that a fixed determination to act can offset fatigue.

A favorable attitude does not perform miracles. It does not, for example, produce work without energy expenditure, although it may induce continued energy expenditure when a fatigued state

strongly demands quiescence. In this particular experiment the will factor is essentially a determination *to carry on*, complicated by the other motivating factors mentioned above. In fact, the "will" which counteracted fatigue is strikingly similar to the "will" which facilitates learning. *Will* is a postural adjustment or set of the subject towards his task. This factor is of paramount significance in the process of motivation—but it is nothing new and unique to motivational psychology.

Voluntary Attention. The problem of will comes up once again in connection with voluntary attention. In every school room teachers can recognize a condition called "inattention." At times the children of the class slump in their seats, look about the room and out of the windows, drop pencils and paper, whisper, borrow handkerchiefs and other objects; or they remain motionless with a far-away pensive look in their eyes and in a state of day-dreaming. Sometimes inattentive children make faces, throw spitballs, and in various other ways are disorderly. But when the children of a class are attentive, by contrast, they sit erect in an alert, observant posture with eyes and sometimes mouths widely open, or they bend steadily over their work. Very few extraneous movements can be observed; there is little whispering and borrowing, for everyone is intent upon carrying out the task in hand.

College students and teachers have repeatedly stated their belief that a voluntary "concentration of attention" is capable of increasing the efficiency of school work. The writer has frequently heard college students complain, "The trouble with me is that I cannot concentrate." If "concentration of attention" means the establishment of a determination to work rapidly, accurately, and persistently upon some task, the prevailing view is undoubtedly correct. And the pedagogical problem is the purely practical one of establishing an effective goal orientation, *i.e.,* building up an adequate determination. The suggestion or command of the teacher to "give attention to this" may be temporarily effective, but all too often this command merely induces a temporary shift of bodily adjustment. The phrase "concentrated attention," if it means anything psychologically, signifies a motor set or adjustment relative to a particular task. The attentive individual is definitely predisposed toward some activity, whereas the inattentive individual for the moment lacks a

fixed goal orientation. The essential factor in voluntary attention is the postural set or adjustment.

Once the attentive set has become established the individual continues along some fixed line of activity; but every now and then there are competing determinations and distracting stimuli which partially obstruct the activity in progress. This inhibition builds up tension which the individual feels as muscular effort; it gives him a sense of exerting will power, of acting under difficulties. When an activity in which we are interested goes along of itself without this sense of effort we do not ordinarily speak of voluntary attention in connection with it. But when we are thwarted and have to attend in the face of difficulties we speak of voluntary attention. In this sense the problem of will centers around the mechanism of determining set and postural adjustment.

Deliberation and Will. There are times when an individual is in a state of doubt or indecision concerning some course of action. If the uncertainty concerns an important result, deliberation is likely to occur. Such deliberation may last for hours or for weeks. It consists of a balancing of one determination against another until finally the mind is made up.

In regard to deciding between alternative courses of action, Benjamin Franklin has left on record a letter to Joseph Priestley, in which he recommends a method of deciding doubtful matters. The method, which is analogous to the balance sheet of business, was described picturesquely by Franklin as follows:

> In the affair of so much importance to you, wherein you ask my advice, I cannot for want of sufficient premises, advise you *what* to determine, but, if you please I will tell you *how*. When those difficult cases occur, they are difficult, chiefly because while we have them under consideration, all the reasons *pro* and *con* are not present to the mind at the same time; but sometimes one set present themselves, and at other times another, the first being out of sight. Hence the various purposes or inclinations that alternately prevail, and the uncertainty that perplexes us.
>
> To get over this, my way is, to divide half a sheet of paper by a line into two columns; writing over the one *Pro* and over the other *Con*. Then during three or four days' consideration, I put down under the different heads short hints of the different motives, that

at different times occur to me, *for* or *against* the measure. When I have thus got them altogether in one view, I endeavor to estimate their respective weights; and where I find two, one on each side, that seem equal, I strike them both out. If I find a reason *pro* equal to some *two* reasons *con*, I strike out the *three*. If I judge some two reasons *con* equal to some *three* reasons *pro*, I strike out *five*; and thus proceeding, I find where the balance lies; and if after a day or two of further consideration, nothing new that is of importance occurs on either side, I come to a determination accordingly. And tho' the weight of reasons cannot be taken with precision of algebraic quantities, yet, when each is thus considered separately and comparatively, and the whole lies before me, I think I can judge better, and am less liable to make a rash step; and in fact I have found great advantage from this kind of equation, in what may be called *moral* or *prudential* algebra.

Most of us do not resolve conflicts in the deliberate, coldly logical, matter-of-fact manner recommended by Franklin. We drift into a decision without knowing what determined us, or we remain indefinitely in a state of indecision. Some act impulsively with little or no deliberation; others have great difficulty in making up their mind. Some hold stubbornly to a determination; others vacillate between determinations even after a decision has been declared. There are clear *volitional* differences in the psychological constitution of individuals.

A question which has long troubled philosophers is that of free will. Can an individual by sheer force of *will* decide what he will do? Certainly the average man believes that he is free to make decisions. But is the belief a delusion?

Some light is thrown upon this question by abnormal cases. Patients suffering from paralysis agitans, Luria pointed out, cannot become less tremulous or less rigid, try as they may. Hysterical persons cannot decrease the speed of their motor reactions by exerting maximal will power. Whole ranges of activity are thus outside the region of voluntary self-control. Again, compulsions, tics, hallucinations, and other dissociated activities usually run their course autonomously, *i.e.,* with no control from the main personality.

Luria has claimed that the normal human adult is unable to control his behavior by the direct application of will power. Self-control,

he states, is always produced by auxiliary stimuli. One highly important source of such controlling stimuli lies in the concealed speech mechanisms. Just as one responds to the verbal suggestions of a friend, so one responds to autosuggestions, such as, "Now I will go to the garage," or "I must make that telephone call." The spoken word supplies controlling stimuli. It may cause the body to assume an inner posture which furnishes stimuli to action. Controlling one's own behavior is thus similar to controlling the behavior of others in that this is always accomplished by means of stimuli. In other words, an action which is impossible by direct application of "will" becomes attainable when the action is formulated into words or when a motor set has been established. The stimulus-response relationship, Luria supposes, is valid for voluntary phenomena as well as for reflexes.

To "will" an action is to assume a determining set which motivates behavior. The problem of free will centers around the conditions which bring a determining set into existence.

ADJUSTMENTS OF THE SUBJECT TO HIS TASK

The voluntary set or determination of the subject restricts activity into a definite channel. The psychologist has to take account of certain more general preparations and adjustments made by the subject to his task as a whole. These place restrictions upon the kind and pattern of activity to be carried out. They furnish the background or context for the particular activity in progress.

For example, when one has listened to a symphony concert for half an hour one is in the mood for musical appreciation; matters of business, if presented, are annoying. Again, when a student first starts to study his lesson it is necessary to go through a stage of "warming up" before the work goes along smoothly. Once he is *set* for the topic at hand, study moves forward of itself; every distraction meets some resistance. Similarly, the average American has a typical *set* (*Einstellung*) for his work, his vacation, his home, his club, his church, his sport, and so on. These *sets* are in the nature of very general preparations, readinesses, or diffuse arousals of the neural mechanisms.

An ordinary parlor conversation furnishes an excellent example of the domination of verbal behavior by general *sets* and moods. Ordi-

narily the first remarks deal with the weather, health, some political event, or other topic of general interest. In a protracted conversation the hobbies of persons present come to the front—dogs, golf, clothing, stamps, books. The men talk about business conditions; the women, housekeeping problems; or some recent lecture, amusing play, or concert is discussed. Each topic lasts for a certain time; sooner or later it is shifted and the talkers all assume another general *set*. An illuminating exercise in the analysis of *set* is to record and later study the peregrinations of an evening's social conversation.

In one of the commoner types of funny story the humor lies in a sudden and unexpected shift of context. In a discussion of legal property rights, for example, the question of ownership arises in the case of an egg laid upon *B*'s land by a peacock which is owned by *A*. Heated discussion upon the legal points frequently overlooks the biological fact that pea*cocks* do not lay eggs! Again, in the context of correct grammar a discussion upon the relative merits of "Five and seven *are* eleven" *versus* "Five and seven *is* eleven" ignores an obvious fact of arithmetic. The joke in such cases lies in the circumstance that an intelligent person is beguiled into making an obvious misstatement of fact through the psychological trick of controlling his general *set*.

Concentration upon a topic may give a similar ludicrous result. I recall approaching my locked office door while absorbed in estimating the cost of a projected piece of laboratory apparatus. Engrossed with money matters, I reached into my pocket (which contained both keys and purse) and absently taking out the purse opened the same and reached in for money. Not until I found myself standing before the door holding a coin to the keyhole did the absurdity of the situation dawn upon me. In this case the general *set* for a consideration of costs and money favored the kind of reaction which has made absent-minded professors famous.

Between the most specific and the most general of preparatory adjustments there are all gradations; no hard and fast line of distinction can be drawn. The most specific determination is a *set* for a definite, limited, precisely defined action. The most general determination is in the nature of an ill-defined mood or readiness for

some type of activity, as to talk about a general topic of conversation, to read or listen to music, to exercise or play. Summing up, general preparation favors some one system of neural organization rather than others; to this extent it is a regulating factor of behavior.

Quantitative Set. The size of the task with which an individual is confronted, and the time allowed him for performing it, are important factors affecting his general preparatory adjustment to the work before him. Myers, in 1915, reported that when a time limit was set for a given task, such as learning groups of words, the speed of learning was increased. His brief report indicates that having a time limit affects the mental attitude of the learner, that a determination to work against time induces what the layman calls "concentrated attention."

In connection with a more recent experiment, Bills and Brown coined the phrase "quantitative set" to designate the preparatory adjustment of a subject with respect to the quantity of work to be accomplished. These psychologists questioned, "Does an individual who is confronted with a large task start off at the same level of performance and maintain the same degree of efficiency as an individual faced with a small task?" To answer this question they performed an experiment in which the subject was given the task of adding pairs of digits arranged in continuous rows on specially prepared sheets of paper. Both the *amount* of work presented and the *time limit* were systematically varied and controlled.

Their results demonstrate that an individual's initial level of performance is directly proportional to the amount of work presented to him, *i.e.,* it varies with his quantitative set. Also the steepness of decrement in the work curve is directly proportional to the amount of work required. For continuous work it is best to break up the big task into separate portions. The total amount of work accomplished is greater, even if the portions be presented with no respite between them, than when the individual is at first confronted with his total task.

The magnitude of the task presented is obviously an important factor influencing one's preparatory adjustment with respect to his activity level. Other factors which affect the adjustment of a subject to his task will be considered in the following sections.

Visual Guidance. In many activities of daily life the eye and skeletal muscles cooperate in regulating behavior. This is true in driving an auto, in writing, in painting, in using tools, and in countless other activities. If the reader will place a piece of paper on his dressing table, and then, while looking in the mirror exclusively, attempt to write his signature or to draw a picture so that it looks right when seen in the mirror, he will realize forcibly the rôle of visual guidance in behavior. In the following two experiments this factor has been studied.

Judd placed before his subject a horizontal line and another line making a visible angle to it, either above (positive) or below (negative). The task of the subject was to place a pencil dot so as to indicate the position the sloping line would take if it were extended. A screen was interposed between subject and pencil so that visual guidance of the hand and knowledge of the true position of the dot were impossible. Nine different angles were used. After a series of trials the experimenter measured the perpendicular distances between the dots and the true extension of the lines, using these measures as indices of error. The data showed both constant and variable errors. Judd states that continued practice brought no improvement as long as visual guidance was withheld; later, however, Spencer demonstrated a slight improvement by manipulating Judd's results.

Judd, in his experiment arranged a special practice series which was limited to two of the lines: 60° above the horizontal (60), and 45° below (−45). In this series the subject at intervals was allowed to pull aside the screen and see the 60° line and the entire blank sheet upon which he was to indicate the projection, but he was not allowed to move his hand while looking, nor was he allowed to do this for −45. After a brief survey the screen was replaced and the trials commenced. There were five trials with 60, then five with −45, then five more with 60, and then five with −45; after these twenty trials the subject was again allowed to see the screen, and then more trials were made.

It is interesting to note that this occasional visual aid resulted finally in the disappearance of the error for line 60; but the error with −45, the line lacking special visual exposure, rapidly increased. The corrections applied to 60 were indiscriminately applied to −45 without recognition by the subject of the inappropriateness of this

transfer. After the above special practice series with two lines the whole group of nine was again used. Judd found that the newly formed habit of adjustment for 60 dominated the other lines completely, so that all of them were projected to new and erroneous positions.

The experiment is especially interesting from the standpoint of habit formation. It shows how incorrect habits are established when visual guidance is withheld, or when partial and unsatisfactory guidance is given. It particularly demonstrates that when there is visual guidance for only part of a task a habit may result that is increasingly correct in the performance guided by the eyes, but that this practice effect does not extend to the unguided portions of the task.

Another experiment upon visual guidance, quite different in aim and scope from the above, was performed at the University of Illinois.* Fourteen college men, in two equal squads, were given practice in "free-throwing" a basketball. The general instruction for both groups was:

"Take the basketball in hand, walk to the free-throw line." Group *A* received this further instruction: "Look at the basket while taking aim and throwing; keep your eyes constantly on the basket." Group *B* received the following instruction: "Look at the basket while taking aim, then close your eyes and keep them closed during the throw and afterwards till the ball has hit the floor."

Thus with Group *A* there was continuous visual guidance during the adjustment of bodily posture and during the throwing; with Group *B* vision was used, to get the preliminary sensory-motor adjustment to the basket, but during the throw guidance was motor only, rather than visual-motor. The groups were wholly unpracticed in basketball at the start and were selected to be equal in motor ability. Each man was given fifty throws per day for the experimental days of six successive weeks. Every throw was scored as a hit or a miss.

Figure 53 gives graphically the number of baskets thrown by the two groups on successive days. The highest possible daily score for each group is 350 (fifty throws, seven men). The curve shows clearly that the rate of learning varied with the sensory-motor adjustment of the subject. Purely motor guidance at the start was dis-

* The work was done by Joseph C. Godfrey under the author's supervision.

tinctly inferior to visual-motor guidance. Continued practice, however, extending over six weeks, brought the two groups to just about the same performance level.

One incidental result is worthy of note, even though it does not relate directly to our present topic. The experimental periods occurred on the early days of the week, not on Saturday and Sunday.

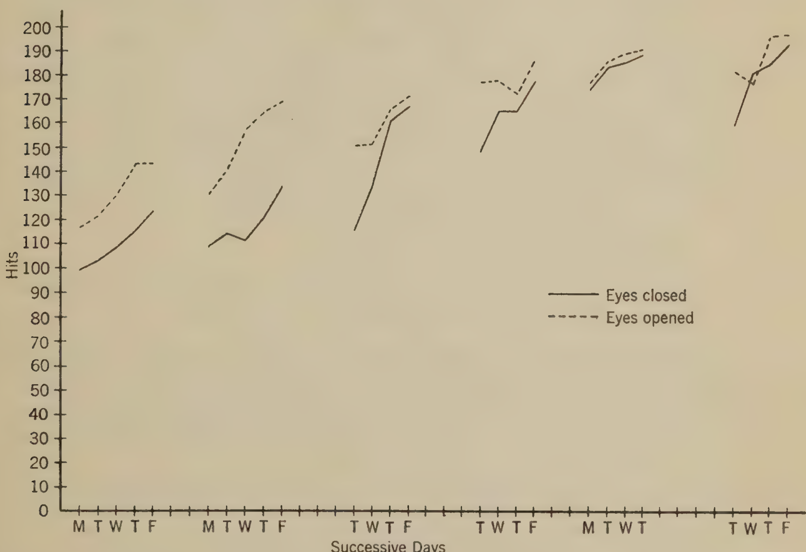


FIG. 53. LEARNING TO "FREE-THROW" A BASKETBALL WITH VISUAL-MOTOR AND MOTOR GUIDANCE.

The dash line shows the number of baskets made by a group of seven men who kept their eyes fixated upon the basket while getting set and throwing. The solid line gives the score for men who first looked at the basket and then kept their eyes closed during the entire throw. The figures on the vertical indicate the number of baskets thrown daily out of the maximum possible number of 350 throws (fifty throws per man, seven men in the group). The letters on the base line indicate days of the week for the six consecutive weeks during which practice was given.

There was, in every case but one, a loss of precision over the weekend when several days of practice were omitted. The lost skill was rapidly regained with fresh practice, however, and the previous week's score was soon surpassed. The rest periods over the weekends are indicated by gaps in the curves of Fig. 53.

The Subject's Method of Learning. In an experiment described by Arps a six-and-one-half-year-old boy learned lists of spelling words by different methods. In one method words were learned

in the order given in the spelling list, and recall was tested in the same order. In the other method words were learned in a random order and recall was tested in a random order. The two methods were alternated from day to day. During the entire experiment the boy learned 808 words arranged in 104 lists.

The results show that for immediate recall the orderly procedure was more effective, the advantage of this method over the other being 9.4 per cent. On the other hand, for remote or delayed recall the random procedure was the more effective one, its advantage being 16.4 per cent. The question of the relative merits of the two procedures, therefore, hinges upon one's aim. If the aim is immediate reproduction, the orderly method is superior, but if one's aim is permanent retention of correctly spelled words, the random procedure is decidedly superior.

The advantage of the orderly method lies in the fact that with it the word list becomes a configuration; if the words of a list are learned and recalled in the same sequence, the temporal uniformity aids fixation of the memory trace. The disadvantage of the orderly method lies in the obvious fact that the aforementioned spatial configurations and sequences are wholly arbitrary and of no permanent value. They are not met outside of the spelling book, and are quickly lost along with whatever immediate advantage can be gained from them. Therefore, practical considerations favor the random method of learning spelling lists even though it gives poorer immediate returns.

The case is somewhat similar to that of learning to typewrite. Everyone knows that when a neophyte begins to use the typewriter his first attempt accords with the familiar method of Hunt and Peck! Although this method may yield passably satisfactory immediate returns, in the long run the more slowly acquired "touch system" is superior.

Many other illustrations could be found to show how the method of learning relates to subsequent performance, but a complete discussion of the topic belongs to the study of learning rather than to motivation. One more example, however, is worth mentioning in conclusion. A boy learned the multiplication tables in regular sequence. When he wished to know the product of *nine times six*, or of *seven times nine*, he would run over the whole table, verbally

counting off the products on his fingers up to the desired combination. This method of mental arithmetic persists even now in adult life. It retards the speed of multiplication for certain combinations, whereas a random method of learning would certainly have avoided the difficulty.

Understanding the Task. The practical importance of the method of learning and of the subject's understanding of his task is revealed in Freeman's experiment. His procedure was to present the subject with a musical chord and at the same time to name a color. For example, in the first part of the experiment four chords were sounded and synchronously four colors named, thus:

1. c-e-g green.
2. B-d-f blue.
3. F-B-d yellow.
4. F-d-a red.

The subject, confronted with four reaction keys which operated as many colored lights, had the task of reacting to a given chord by pressing the key which corresponded to the appropriately colored light.

The chords were first given and colors named, three times over, in an order corresponding to the arrangement of the keys and then, also three times over, in a haphazard order. In every case the subject made the appropriate reaction. This program was repeated for three practice hours.

Then the procedure was changed. The chords were presented one at a time, as before, but in no case was the color named. When the naming was discontinued it appeared that, despite frequent repetitions, no one of the four subjects had learned to associate the sounding chord with its corresponding color name. This is understandable if we assume that the subjects had been reacting to the names of the colors.

A more interesting fact, however, is that no subject succeeded in learning the association between unnamed chord and color in twelve to eighteen practice series of twenty trials each! The learning curves were virtually level. Something obviously was wrong with the procedure, so a second method was tried. Four other chords were

selected which could easily be arranged in a series from smooth to rough, thus:

1. C-E-G smooth.
2. B-D-F less smooth.
3. C-D-A definitely rough.
4. C-G-A very rough.

The aspect of roughness was demonstrated and the subjects were trained to differentiate the chords according to the degree of roughness.

After this the original four chords were presented, along with a new instruction: to select some aspect for differentiating the chords. The new procedure involved organizing the four chords into a single configuration on the basis of a common element. Under this instruction all subjects learned rapidly and unmistakably to recognize the chords and associate them with the corresponding colors. No subject was aware of the aspect of the chords chosen by the others for differentiation. One took size or volume; two selected degree of dissonance; the fourth, texture. The fact that each subject was successful indicates that achievement was a function of the method involved, not of the particular tonal aspect selected as a basis for comparison. Apparently what was needed to effect learning in this case was a new understanding of the nature of the task, and a more adequate method of learning.

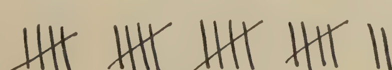
Freeman concludes that with complex presentations mere repetition is an uneconomical method of learning. Economy in learning requires that the materials be organized into a structure. The experiment shows the advantage of singling out some one aspect of the materials to be learned and attaching structural significance to it. In the process of learning, therefore, much depends upon the individual's understanding of his task and the method he uses in carrying it out.

Working with Knowledge of Results. Arps demonstrated that there is greater efficiency in ergographic work, both in terms of the quantity of work accomplished and of the rate of working, when the subject knows the results of his performance than when such knowledge is withheld. Similarly, the experiment of Johanson (pp. 14-16) showed that, when the subject was told the speed of

his responses, this knowledge of results brought quicker reaction times than when the information was withheld. Again, the study of Crawley upon work done with arm and leg muscles (pp. 16-18) revealed that a clear view of the extent of bodily movements yielded increased expenditure of energy. One of the important facilitating factors in many other researches is the subject's knowledge of results.

The student in the class room, the workman in the factory, the bank president in his paneled office shouldering grave responsibilities, anyone carrying on any sort of continued activity, is accelerated in his performance of duties and tasks at hand by a definite knowledge of previous results. Such knowledge is effective in part because it gives rise to self-competition with the attempt to excel one's previous record, and to rivalry with others; in part because it presents a definite standard derived from past work to be maintained or surpassed; in part because it puts emphasis upon the quantity and quality of work and therefore constantly predisposes the subject towards a consideration of the nature of his performance; in part because merely seeing the results of one's labor is in itself satisfying, and creates a more favorable attitude than does work which is done in ignorance of results. In everyday life all the foregoing factors are rendered more effective by the realization that personal success or advancement depends to a large extent upon improving one's record or surpassing one's competitors.

A direct experimental attack upon the knowledge-of-results factor was made by Ross, whose subjects, equivalent groups of college students, worked with three degrees of information about results: *complete, partial, none.* The task which they carried out was the making of talleys, *i.e.,* four vertical lines crossed by a fifth diagonal, as quickly and accurately as possible, thus:



In the group working with *complete information* each subject was shown his paper of the previous day with scores and corrections upon it. A table of scores for the group as a whole was placed on the board, and each subject was urged to watch his daily progress, both relative and absolute. In the group working with *partial information* the subjects were told which persons were above and

which below the average for the section; they were not told how much above or below, nor given any other information. In the third group *no information* was given as to progress. Subjects were told to do their best but to refrain from keeping track of progress. They heard what was said to the second section, and all subjects knew what kind of work those in the first section were doing.

The score was based upon the quantity of work accomplished. A talley was marked "wrong" if the cross-line failed to touch all four verticals, or if more or less than four vertical lines were used. The scores for the three sections were approximately the same for the first and second days—perhaps while novelty and inexperience lasted. Then as practice continued the section with complete knowledge of results gained steadily in speed and remained consistently ahead of the other two sections. For a while the second and third sections were about equal, but somewhere between the seventh and the tenth practice periods the section with partial knowledge of their results gained slightly over the one with no knowledge.

After expressing the gains in terms of percentage of the initial level Ross states: "From the first practice period to the tenth inclusive, the section with full information gained from 2.2 per cent to 8.5 per cent more than the section with only partial information, the average advantage being 8 per cent." This experiment is one of many which demonstrate clearly that information regarding one's score is a facilitating factor in learning.

Attitude towards the Task. Discussions of motivation have a good deal to say about enthusiasm, interest, initiative, self-confidence, ambition, cooperation, and similar factors. Taken together, these terms, with their opposites, describe what is commonly called the *attitude* of the individual towards his work.*

In a study of several retarded school children Strong and his collaborators aimed to develop an attitude of enthusiasm, self-confidence, and readiness to take initiative, while tutoring them in arithmetic. Deficiencies were discovered and corrective drill given. The essential feature of the study was the plotting of learning curves so that a child could see objectively what progress he was making in adding, subtracting, multiplying, and dividing. Three conditions

* The term *attitude* has been defined in a narrow sense to designate the predisposition to react positively or negatively to some opinion. See p. 242.

were essential: first, an enthusiastic assumption that the child could learn; second, the discovery of precisely what the child *could* and *could not* do; and third, a restriction of practice to those branches where progress could be demonstrated by learning curves. This method succeeded in producing a changed attitude in the children. The change not only enabled them to make better progress in arithmetic, but also to achieve general improvement in their other school subjects.

The importance of attitude can be illustrated further by reference to laboratory experiments upon memory and learning. For example, if a subject merely *reads* the nonsense syllables of a series which are flashed one at a time before him, his learning is exceedingly slow. If, however, he has a definite *intent to learn*, the speed with which associations are formed is decidedly quicker.

Wohlgemuth controlled the factor of attitude in an experiment which required the subject to associate pairs of differently shaped, colored and black figures which were placed upon a variety of backgrounds. Two instructions were used. The first required the subjects to look passively at the exposed materials while assuming a *spectacular attitude*. The second required them to make their best effort to learn the pairs, to assume a *learning attitude*. It is hardly necessary to add that the *learning attitude* produced much quicker learning than did the *spectacular attitude*.

THE FACTOR OF HABIT

In his famous chapter upon habit, William James relates the old story of the practical joker, who, seeing a discharged veteran carrying home his dinner, suddenly called out, "Attention!" The man instantly brought his hands down, and lost his mutton and potatoes in the gutter. The soldier's drill had been so thorough that its effects had become embodied in his nervous structure.

James continues his discussion of habit as follows:

> Habit is thus the enormous fly-wheel of society, its most precious conservative agent. It alone is what keeps us all within the bounds of ordinance, and saves the children of fortune from the envious uprisings of the poor. It alone prevents the hardest and most repulsive walks of life from being deserted by those brought up to tread therein. It keeps the fisherman and the deck-hand at sea through

the winter; it holds the miner in his darkness, and nails the countryman to his log-cabin and his lonely farm through all the months of snow; it protects us from invasion by the natives of the desert and the frozen zone. It dooms us all to fight out the battle of life upon the lines of our nurture or our early choice, and to make the best of a pursuit that disagrees, because there is no other for which we are fitted, and it is too late to begin again. It keeps different social strata from mixing. Already at the age of twenty-five you see the professional mannerism settling down on the young commercial traveller, on the young doctor, on the young minister, on the young counsellor-at-law. You see the little lines of cleavage running through the character, the tricks of thought, the prejudices, the ways of the "shop," in a word, from which the man can by-and-by no more escape than his coat-sleeve can suddenly fall into a new set of folds. On the whole, it is best he should not escape. It is well for the world that in most of us, by the age of thirty, the character has set like plaster, and will never soften again.

If the period between twenty and thirty is the critical one in the formation of intellectual and professional habits, the period below twenty is more important still for the fixing of *personal* habits, properly so called, such as vocalization and pronunciation, gesture, motion, and address. Hardly ever is a language learned after twenty spoken without a foreign accent; hardly ever can a youth transferred to the society of his betters unlearn the nasality and other vices of speech bred in him by the associations of his growing years. Hardly ever, indeed, no matter now much money there be in his pocket, can he ever learn to *dress* like a gentleman-born. The merchants offer their wares as eagerly to him as to the veriest "swell," but he simply *cannot* buy the right things. An invisible law, as strong as gravitation, keeps him within his orbit, arrayed this year as he was the last; and how his better-bred acquaintances contrive to get the things they wear will be for him a mystery till his dying day.

Habit is undoubtedly a fundamental regulating process of behavior. Who has not admitted, "I did so and so because of habit," or "I acted automatically without thinking"?

Evidence enough has been presented for the statement that habit formation goes on only when an individual is motivated. But it should be emphasized here that, once a habit has been established, its neural organization restricts behavior into definite channels.

Pavlov's Researches. The following excerpt will serve to re-recall Pavlov's well-known work:

> The dog is put into a dark room, and at a certain moment a bright electric light is switched on. We wait for a half minute, and then give the dog food and allow it to eat for a half minute. This procedure is repeated several times. Finally the electric light, which at first was an indifferent agent for the animal, and had no relation whatever to the function of the salivary gland, owing to repeated coincidence of eating with salivary activity, becomes endowed with the property of acting as a special stimulus for the salivary gland. Every time the electric light appears we have a salivary secretion. Now we can say that the light has become a conditioned stimulus of the gland. The activity of the salivary gland in such a case serves as a simple index of the reaction of the animal to the external world. This reflex gradually grows until it finally attains a certain limit, in the present case, ten drops of saliva in half a minute.

Prior to conditioning, the light did not symbolize food, but after the repeated association of light with food, the former came to be a signal for the latter. The light prepared the dog for food, as shown by the augmentation of salivary flow, just as the dinner bell prepares a man for his meal.

That some motivation is essential to the formation of conditioned reflexes is proved by reference to the following experiment upon conditioned reflexes of the second order:

> We now add to the light a definite tone (of about 426 vibrations per second); the simultaneous action of the two . . . is represented by *L* plus *T*. The combination of light and tone lasts half a minute. This combination of stimuli is never accompanied by feeding. For the first few applications of this combination there is no change in the original effect of the light, *i.e.,* the light plus tone gives the same salivary secretion as the light alone did (ten drops in half a minute). I wish to emphasize that this combination is never accompanied by food. We ask ourselves, however, the following question: Although apparently there is no outward change, may it not be possible that there has taken place in this process some intrinsic transformation? Has not the tone which we have joined to the light and which formerly had no relation to the salivary gland become something other? And after four or five applications of this combination (without feeding), the tone had acquired the property

of acting as a stimulus of the salivary secretion. It is true the effect was very small, only one or two drops. But what does this signify?

The tone, which never had been associated with food but only with a symbol of food, eventually brought a slight increase in salivary flow when it was presented alone. This secondary conditioning, Pavlov found, was not permanent; when the double stimulation (L plus T) was presented repeatedly without food the conditioned response became extinguished. Pavlov continues:

So the first result of the combination (tone plus light), which is never accompanied by eating, consists in this: the tone also becomes a conditioned stimulus. Repeating this double stimulation ten to twenty times and never supporting it by feeding we arrive finally at the next phase. If this combination during the first four or five applications gave the same effect as the light alone, then afterwards the action of this combination begins to decrease, and instead of ten drops, it produces eight, five, four, three, and finally no drops. So the light (L) alone yields ten drops, and the light plus tone ($L + T$), zero. This last state remains stationary; repeat the double stimulation as much as you will, you see no change.

Stated in other words, a discrimination was established between L (signal for food) and $L + T$ (signal for no food). The result is in line with Williams's experiment upon symbolic rewards (pp. 301-303). Pavlov's work demonstrates unmistakably the basic importance of motivation in the formation and retention of the conditioned reflexes. It shows that, once a bit of habit organization has been acquired in the nervous system, this structure may, for a while, still regulate behavior even after the original incentive is withdrawn.

Motivation *versus* Drill in Human Learning. One question which has been considered by educators and psychologists alike concerns the relative importance of motivation and drill in human learning. Educators differ markedly in the emphasis which they have placed upon these factors. Some stress the importance of practice and repetition; motivating devices, they say, are needed merely to make the children drill without resentment, for by drill they learn. Others emphasize motivation, arguing that practice is nothing more than a means of attaining the goal; and that unless drill is accompanied by interest and zeal learning does not occur.

According to the second view, motivation is a necessity; the more adequate the motivation the less the need for drill in learning any given task.

The above argument upon the relative importance of drill and motivation reminds one of the heredity-environment controversy in that the argument turns upon the relative importance of two groups of factors both of which are known to be important. No amount of motivation will teach one to typewrite or play the violin skillfully without practice. On the other hand, blind, unmotivated practice is a most uneconomical method of learning and in some cases it is wholly ineffective. The emphasis of Dewey and others upon interest and adequate motivation has given rise to the project method of teaching. Class work which goes along without a vital and definite objective in the mind of each student is in danger of becoming deadly. The project method is based upon the recognition of this fact. In a course of educational psychology at the University of Illinois the problem of "How to study" was selected as the central project. This topic furnished excellent motivation for the whole course, and special attention to the factor of silent reading brought fairly startling results from the class.

One experiment which emphasized *drill* as opposed to motivation is that of Symonds and Chase. These experimenters gave groups of sixth-grade children drill in the correct use of English. The subjects worked in three groups under different motivating conditions.

First, under "no motivation" the children worked upon the Charters Diagnostic Language Test as a regular school exercise directed by the teacher. The writers state that the purpose of the test was to determine the effect of sheer practice without motivation. It is obviously incorrect, however, to speak of work done in the school room in the presence of a teacher as work without motivation. Second, the same tasks were carried on in another school under "test motivation" conditions. The children were told the results of their labor and urged to improve their scores; this encouragement plus knowledge of results furnished the additional incentive. In a third group an attempt was made to arouse "intrinsic motivation," *i.e.,* to interest the children directly in improving their language usage. Material was read which illustrated the value of the correct use of English, and this material was then discussed. The writers state,

however, that the stories failed to arouse a desire for the better use of English. The hoped-for "intrinsic motivation" was not successfully evoked.

From the results Symonds and Chase conclude that the amount of drill, as measured by the number of repetitions necessary to learn the test material, is the most important factor in learning. *Drill,* the experimenters concluded, is more important than motivation.*

ORGANIZATION AND DYNAMIC DETERMINATIONS

We have just seen that drill and practice leave their effects upon the organism. They build up neural structure which restricts and regulates behavior. In the following pages we will consider a distinction of paramount importance: that between passive organization within the nervous system, on the one hand, and dynamically active determinations which arouse and direct human and animal behavior, on the other.

Bodily Structure as a Limiting Condition of Behavior. One of the most fundamental and at the same time general principles for the explanation of behavior is the mechanical structure-function principle. This principle is shown in the functioning of a machine such as a watch or a locomotive; the structure of the mechanism places limitations upon the processes which occur in it. The same principle applies, though not so obviously, to the behavior of organisms. In a bird the wings, together with the muscles which move them, the connecting nerves, and receptor organs, make up a complicated structure by means of which flight is possible. In the case of a simple reflex the detailed structure of the nervous system plus the muscles involved in the reflex act are the essential parts of a bodily mechanism which functions when the adequate stimulus is applied.

Bodily structure is not static; it is constantly developing, both with maturation and as a result of activity. The fertilized egg contains within itself chemical determiners which regulate the development of structure, and along with structural development, patterns

* In the author's opinion, this problem of motivation *versus* drill needs to be worked over more systematically. It is clearly possible to plan an experiment for the purpose of determining the *practice equivalent* of an added incentive.

of behavior appear and disappear. Maturation and learning go hand in hand, and this makes it often very difficult to determine whether a given segment of behavior has been learned or whether it appeared merely as a result of structural maturation.

Well-known facts regarding learning compel the psychologist to assume that the process of learning either *is* or *involves* a modification of the structure of the nervous system. Although the ultimate nature of these neural modifications is still somewhat obscure, the assumption of structural modification cannot reasonably be doubted.

Professor Warren has used the term "set" to describe the relatively permanent structure of the nervous system in so far as it consists of traces left in the nerve substances by previous nerve impulses. In this sense, "set" is purely a structural conception. Warren's use of the term is very different from our usage (pp. 195-205), which refers always to a dynamically active, or motivating, determination.

Latent neural organization is inert and of itself does not motivate, any more than the structure of the railway track makes the train move. Bodily structure *as* structure and *of itself* does nothing. This is true of the gross anatomical structures as well as the fine ones, and of the structure assumed to exist in the nervous system as a result of learning. Structure is a condition of function; structure limits behavior, but *qua* structure it is inert.

The distinction of importance in the present discussion is that between (*a*) conditions which place limitations upon behavior (limiting conditions) and (*b*) conditions which cause behavior (causal conditions). Gross bodily structure and much of the acquired neural structure are of the first kind; they place limitations upon what can and what cannot be accomplished by an individual, but they do not motivate.

Latent Neural Organization and Dynamic Determination. The term "habit" is appropriately applied to acquired patterns of movement which run off in a fairly automatic manner. Repeating the alphabet, typewriting a word, turning a doorknob—these bits of behavior have been thoroughly learned; they have become stereotyped. Yet these habits do not run themselves off apart from motivation.

At any given time most of the neural organization which determines habitual reaction is idle. Right now, for example, I have

neural organization needed to play any one of several pieces on the piano, to manipulate a variety of tools in the workshop, to drive an automobile, to write many thousands of words with a pen, to carve a turkey, to recite numerous verses of poetry, and so on. But the neural organization is latent; I have no determination at present to do any of these things. The latent organization does not in the least disturb me. I know it is there when I think about the matter, but at present I experience not the slightest impulse to start to the piano, the workshop, the garage, the writing desk, the dining room, to recite poetry, etc. Mere neural organization of itself does not motivate; as organization it is inert.

Woodworth wrote: "A man carries around with him a vast assortment of possibilities of action. The best conception of a 'possibility of action' is undoubtedly that of a neural mechanism so connected with other neural mechanisms and with the sense organs and muscles as to give the action when aroused. The question now before us is as to what determines which of the many possible actions shall become actual at a given time—as to how some are activated while others are left inactive—as to the arrangement by which drive is at any moment applied to certain mechanisms and not to others. It is a question of selection, management, and control."

Although Woodworth is very clear in stating that a given habit mechanism may be driven by a variety of other mechanisms, he also states that a mechanism when in action may furnish its own drive. He writes: "The great aim of the book [*Dynamic Psychology*] is, that is to say, to attempt to show that any mechanism—except perhaps some of the most rudimentary that give the simple reflexes—once it is aroused, is capable of furnishing its own drive and also of lending drive to other connected mechanisms." Thus an activity, when aroused, Woodworth believes, can run of itself, no external motivation being required; and further, an activity in progress may motivate other activities.

This view of Woodworth's that an activity in progress furnishes its own drive and that it may also furnish drive to other activities raises at least two distinct psychological problems. First, there is the problem of hedonic motivation. Many pleasing activities such as playing with colored pigments or musical tones, beating time to music, dancing, playing ball, etc., are carried on for their own sake.

They appear to run of themselves—to furnish their own drive—without any external motivation, but the fact that pleasantness is present at least suggests that some tension-reducing process is involved. The pleasantness of these activities is commonly regarded as their motivating factor, but this view is manifestly inadequate. Pleasurable activities in relation to motivation will be considered in Chapter VII. It suffices here to say that pleasantness and interest do not offer scientifically sound explanations of behavior; they are rather phenomena which themselves are in need of explanation.

Second, there is the problem of latent neural organization *versus* specific determination. This is the point which concerns us now, and it has to do with the question of whether an activity in progress is capable of running of itself. It is well to realize that latent neural organization does not represent a determination to do anything, to go anywhere, or to act in any particular way. It is by definition latent, a mere "possibility of action" as Woodworth called it. But there is another kind of neural or neuromuscular organization which motivates and directs. This dynamically active type of organization may be spoken of as a determination to act.

When a dog chases a rabbit he sniffs the ground, jumps the fence, swims the stream, barks while running, etc., and the entire process is oriented with respect to that particular moving object. The path of the rabbit determines the path of the dog. Again, when a man pursues his hat blown by the wind he turns and dodges this way and that; his behavior is constantly oriented towards the receding headgear. In such cases a specific determination dominates the organism's activity.

The specific determination brings into play whatever latent neural organization is needed to arrive at a final adjustment. The determination to buy a razor, for example, involves turning the doorknob, unlocking a door, manipulating the pedals and levers of an automobile, speaking sentences in the English language, etc. These and many other habitual reactions are called into function precisely at the moment when they are needed. The situations in which these habituated reactions occur are never twice the same, yet the reactions are all adjusted to the main purpose.

The relation between latent neural organization and dynamic determination is well illustrated in the following experiment de-

scribed by Dashiell. On a single sheet of paper were printed one hundred simple arithmetic problems, including twenty-five in each of the four fundamental processes—adding, subtracting, multiplying, and dividing. The problems were presented in a continuous order, *i.e.,* in the first column were all the addition problems, in the second all the subtraction, and so on. On another sheet the very same problems were given in a mixed or random order. The two types of arrangement are illustrated below.

Continuous Order

$4 + 5 =$	$13 - 5 =$	$2 \times 8 =$	$12 \div 2 =$
$7 + 8 =$	$4 - 2 =$	$7 \times 9 =$	$28 \div 4 =$
$5 + 3 =$	$14 - 9 =$	$5 \times 8 =$	$8 \div 2 =$
$4 + 6 =$	$10 - 2 =$	$4 \times 7 =$	$20 \div 4 =$
$2 + 7 =$	$8 - 7 =$	$3 \times 8 =$	$15 \div 5 =$
....	....	$8 \times 7 =$	$24 \div 3 =$
....	....	....	....

Mixed Order

$8 + 2 =$	$4 \times 7 =$	$9 + 9 =$	$6 \times 6 =$
$2 \times 6 =$	$8 - 3 =$	$24 \div 4 =$	$3 + 9 =$
$15 - 8 =$	$2 + 9 =$	$5 \times 5 =$	$9 \times 3 =$
$24 \div 3 =$	$21 \div 3 =$	$8 - 4 =$	$6 - 3 =$
$3 \times 4 =$	$5 \times 8 =$	$7 \div 1 =$	$16 \div 8 =$
$5 - 9 =$	$7 + 3 =$	$8 + 6 =$	....
....	....	....	....
....	....	....	....

Sixty-nine persons, who served as subjects, were instructed to jot down the answers as rapidly as possible. A record was made of the time taken to complete each sheet. Sixty-three of the subjects (91 per cent of the group) required less time to complete the problems arranged in continuous order than those that were mixed, the average time for the two orders being 159.3 and 181.7 seconds, respectively.

The explanation of the above temporal difference lies in the fact that it requires time to shift one's mental set from adding to multi-

plying, dividing, or subtracting. The continuous order, of course, necessitated fewer shifts of set than did the mixed one. Incidentally, the experiment teaches a lesson of practical importance: it is economical of time to plan one's work so that shifts of set are at a minimum.

During the years of elementary-school training most individuals acquire a neural organization which makes it possible to solve simple problems in arithmetic, but this organization remains latent until some specific problem calls upon it. Nearly everyone possesses neural organization which makes it possible to say, "four plus five is nine," "twenty-four divided by three is eight," and so on, or which makes one think of "12" when "4×3" is seen on a piece of paper. There is a "determining tendency," as Ach once explained, which selects out certain associations from various potential ones. Thus, if the instruction be *add*, the figures 4 and 2 give the answer 6; if the instruction be *multiply*, the same figures give the answer 8. Ach's "determining tendency" is thus a further example of what we prefer to call a specific determination. His illustration obviously implies the distinction between latent neural organization and determining factors.

In view of the above discussion it is clear that the present author believes all activities in progress to be motivated, even though the motivation be obscure or wholly unknown. When an activity seemingly continues of itself, and especially when it dominates secondary activities, the process is one of energy release which is specifically directed by some inner determination.

An activity in progress usually continues to run to completion; that is because its motivation persists. The bare fact that an undisturbed activity goes on until completion or satiation is reached indicates the existence and persistence of motivating conditions. Latent neural organization of itself does nothing and can do nothing, except limit and direct activity much as a railway track limits and directs the path of the locomotive.

Neural and Mental Organization. Mental organization is assumed to be identical, in reality, with part of an individual's neural organization. The psychologist of today is concerned with a single living organism, not with a body plus a mind. To be sure, this organism is being analyzed from diverse points of view. The

terms "mental" and "neural" presuppose different viewpoints. On the one hand, the phrase "mental organization" presupposes the standpoint of an individual who is the subject of conscious experiences. "Neural organization," on the other hand, implies an objective point of view, that is, a behavioral and physiological one. This difference in viewpoint is not incompatible with the basic hypothesis that mental and neural organization are, in reality, identical.

When we say that a person has knowledge about a place, situation, problem, topic, or field of science, we mean that through previous experience he has built up a certain mental or neural organization relating to that subject. The nature and extent of this organization can be revealed by questions in the form, "Tell me what you know about *x*?" or perhaps by placing the individual in a test situation and observing how he reacts to it. For example, if I want to discover whether a man knows how to operate a power lathe, I can ask him questions about its construction and use, or I can take him to the machine shop and give him the task of turning out a ladder-rung. A class-room examination is literally a test to explore and reveal the extent and nature of some particular system of mental organization.

It is an emphasis upon individual conscious experience, as contrasted with neural process, which differentiates the *mental* from the *bodily* study of organization. The conscious individual lives in a world of his own perceptions, thoughts, impulses, emotions, desires, dreams; he reports and describes these experiences verbally. On the basis of such reports psychologists have constructed hypotheses about mental organization which are of greatest importance in understanding an individual. Mental organization has its real locus within the brain, but it differs from other neural organization in that it is assumed to exist and considered wholly from the standpoint of the individual who lives consciously in his own persisting world. Inasmuch as the individual point of view is practically important only where verbal descriptions of conscious experience can be obtained, this approach is restricted to human psychology.

Once the individual point of view has been taken and the assumption of mental organization made, it becomes necessary to distinguish latent mental organization from the dynamically active determinations which call it into play. Precisely the same distinction

which was drawn between latent neural organization, and the specific determinations which call upon it, exists as well when the individual viewpoint is assumed.

The verbal organization acquired through speaking a foreign language may pass into disuse and remain latent as inert mental organization. Again, the ability to play a Beethoven sonata may not manifest itself for many years. Whole segments of mental organization remain latent and inert most of the time. As *latent*, they place limitations upon the individual or open up possible channels of behavior to him, but they are not causally determinative. A mental determination or set is definitely motivating as, for example, in the case of a resolution or intention to carry out some definite plan. When a decision has been made the determination calls the appropriate organization into play.

Such mental determinations persist even when the awareness of them is temporarily suspended as during sleep. They definitely regulate and direct behavior. Whether determinations be pictured in neural or in mental terms does not change the real nature of the motivational processes.

The Verbal Control of Behavior. The development of language more than anything else has widened the gulf between man and other animals. The importance of speech in the social order can scarcely be overemphasized. The spoken word is vastly superior to the more primitive means of human communication through the use of gestures.

The word frees the individual from his immediate surroundings, enhancing his ability to think symbolically before acting overtly. A spoken word may cause an individual to think of a person, a tree, a ballgame, a melody, a conversation, a mathematical problem, or any other definite bit of past experience. The word is thus an easy means of manipulating past, present, and future events as well as timeless relationships.

A series of words is capable of causing the individual to live over again some complex sequence of past experiences. As the words are heard the emotional and dynamic phases of previous reactions tend to be reinstated. Every soapbox orator who incites a crowd knows well the effectiveness of words. Through speech he can suggest any activity to his audience, and unless there be inhibiting

factors the suggestion has some likelihood of being carried out overtly. If immediate action does not result, at least a changed attitude remains which limits future action or predisposes to it.

There is a certain equivalence between verbal organization and gross behavior. The word "go," for instance, is equivalent to the act of going; the word itself tends to build up a neuromuscular preparation for that action. The more specific words "go to the city" symbolize an elaborate and extended plan of action; they stand for the gross activity itself.

On account of this equivalence the spoken or written word may indicate an intention to act; it may order or command a person to carry out a particular course of conduct or symbolize an impending action. For the above reasons verbal organization is fundamentally important in the social control of human behavior.

The significance of verbal control is clearly seen in the case of an adult giving orders to a child. The child, being uninhibited, accepts the suggestions when given, without much resistance. An example is found in the Stanford revision of the Binet tests for the five-year-old.

A test of three commissions is presented by use of the following instructions: ". . . Here's a key. I want you to put it on that chair over there; then I want you to shut (or open) that door, and then bring me the box which you see over there. . . ." If the instruction is understood, accepted, and carried out, the child passes the test. While the child is receiving the instruction he may look at the objects mentioned and possibly start towards them. Normally he is restrained until the entire instruction has been given and then he attempts to carry it out. Before the child starts on his three commissions, his organism has been *set* or determined by the verbal instruction. The instruction establishes a specific determination which in turn dominates subsequent behavior.

The case is duplicated in everyday life by the mother who instructs her child: to go to the grocery store and purchase a loaf of bread, then to go to the butcher shop and ask for the meat, and then to come straight home. As the child leaves the house his organism has been specifically determined by the instruction. To an outsider, ignorant of the words spoken by the parent, the child's be-

havior would be unpredictable; but with knowledge of the instruction his action would be understandable and to a certain extent predictable.

An interesting and extreme illustration of verbal control is found in post-hypnotic suggestion. For example, during hypnosis the suggestion may be given to the subject that two hours later when the clock strikes twelve he will grasp his pocket handkerchief and wave it in the air. The subject awakens from hypnosis quite unaware of the determining set, but when the clock strikes twelve the suggested action is carried out correctly, and then completely forgotten. To account for this phenomenon one must assume the existence of a temporary determination or set, established by verbal suggestion. In the same way, though less spectacularly, words in everyday life as truly as non-verbal conditions serve to build up specific determinations. The following monologue of a negro janitor in a hotel lobby is *à propos*.

Funny how I got dis job. One day the onah says to the managah: "I believe dis floo' ought to be mopped." So the managah goes to the head clerk and says: "Don't you think dis floo' ought to be mopped?" Of cose, the head clerk said he believed it did, so he says to head potah, "I think dis floo' ought to be mopped." Then the head potah he says to me, "Sam, dis floo' ought to be mopped." Well, I thought so too, but I had no one to tell it to so I mopped it myself.

Attitudes and Their Measurement. The term "attitude" is usually applied to the more complicated mental structures which can be expressed verbally, but attitudes exist whether or not they are verbalized. The dyed-in-the-wool republican, the ardent churchman, the militant suffragist, show their attitudes in deeds as well as in words.

Attitudes, in many forms and in all degrees of stability, exist universally—in all human beings and toward many things in their environment. There are, however, certain ranges of experience within which very pronounced attitudes are especially likely to develop—political, economic, religious, ethical, racial. Surprisingly enough, an individual can rarely give an adequate account of how he developed his biases and prejudices.

The main characteristic of an attitude is that it predisposes the individual to react positively or negatively, to accept or reject, a given proposition. Some of our simple likes and dislikes, as the liking for sugar, warmth, and muscular relaxation, or the disliking for quinine, pain and tiresome work, are clearly unlearned; they depend upon innate bodily structures. On the other hand, the great bulk of our attitudes are acquired. Whether an individual accepts or rejects a given proposition depends upon his mental organization, which in turn depends upon his psychological history.

This psychological history, beginning at birth, includes the witnessing of chance remarks, conversations, and behavior in the home and the surroundings of early life, as well as all the experiences of adulthood. From all this, but especially from the earlier influences, one becomes inclined toward or away from persons, events, objects, and complex situations, and often acquires pronounced biases in many vital fields, without remembering how or why the development came about.

For instance, the attitudes which an individual possesses towards such complex matters as communism, kidnaping, the new deal, Hitlerism, and religion are all acquired, earlier or later, from the social environment, even though the person himself does not know the sources of his prejudice.

It is necessary, if attitudes are to be measured, to accept a somewhat limited definition of an attitude, describing it as that *mental organization which predisposes an individual towards or away from a verbal statement.* One obvious difficulty with this definition is that most verbal statements fail to receive unqualified approval or disapproval; there are complicating pros and cons which in some respects make the reaction *yes* and in other respects *no.* Also there are varying degrees of emphasis upon *yes* and *no.* Further, there are complex attitudes towards one's self, one's work, one's country, which cannot easily be put into words, and which cannot be definitely related to a positive or negative reaction.

One must keep these difficulties in mind, while holding to the above definition. In order to measure attitudes it is necessary next to specify a continuum along which attitudes can be arranged from

the most vigorous and wholehearted approval through indifference to the most vehement disavowal. For example, attitudes toward war and toward prohibition range between the following extremes:

Pacifism .... Militarism
Wet .... Dry

In complicated matters such as the nature of democracy it is difficult to find well-defined continua, for opinions are multidimensional. Nevertheless, if such attitudes are to be measured, the topic must be resolved into a number of simpler components each one of which can be reacted to positively or negatively.

Thurstone and Chave have applied psychometric methods to the study of attitudes. In an experimental work with attitudes toward the church their first step was to collect a large number of statements of opinion about the church such as: "I believe the modern church has plenty of satisfying interests for young people." "I have seen no value in the church." "The Roman Catholic church is the highest religious authority in the world." After 130 such statements were selected, each one was placed on a separate piece of paper and 300 persons were then instructed to arrange the opinions in eleven piles, from those showing the highest appreciation of the church to those showing the strongest depreciation. The piles were marked by letters from *A* to *K*, with those two letters at the two extremes, and with a neutral position, *F*, indicated as such. Intermediate categories were not defined, but the steps between the adjacent letters were assumed to be subjectively equal.

Results were tabulated so as to reveal what percentage of the 300 persons placed a given statement in each category. The graphic representation of these percentages gave curves from which a scale value, representing the degree of church approval or church disapproval, was readily determined for each particular statement. The 50 per cent point of a curve located a scale value on the series of steps between approval and disapproval, and the interquartile range served as an index of ambiguity or spread of opinion. After examining the scale values of the 130 opinions about the church forty-five statements were selected which gave approximately equal separations on the scale.

Ambiguous and irrelevant statements were avoided.* A statement such as, "I am interested in a church that is beautiful and that emphasizes the esthetic side of life," may be endorsed by the most pious church member as well as by the most outspoken atheist. Hence this statement does not differentiate attitudes toward the church pro and con, but is ambiguous so far as the continuum in question is concerned.

After the attitude scale was completed it was tested with groups of students in the Liberal Arts and the Divinity schools at the University of Chicago; it was also tried out with other groups. The scale proved useful and practical in differentiating attitudes toward the church within the groups tested.

An attitude scale measures the verbal expression of mental organization as indicated by the acceptance or rejection of a series of opinions. This measure does not imply that an individual will necessarily act in accordance with the opinions he has endorsed, even though in most cases it is true that word and deed agree. There is interest in discovering what people *think* or at least *say* they believe, even if their conduct be inconsistent with their professed opinions. If attitudes are distorted, the measure at least reveals what persons are trying to make others believe that they have in their mental organization.

An attitude measuring scale makes it possible to determine the mean attitude of a group, the dispersion of attitudes within a group, and the effect produced upon the distribution of opinion by various factors such as a sermon, lecture, motion-picture film, broadcast, or the news of an election, kidnaping, or war. It also gives a measuring stick by means of which an individual can discover the opinion most representative of himself, and the range of opinion he will and will not accept.

Before concluding this discussion of mental attitudes it is well to remind ourselves again of the distinction between passive mental organization and active determination. The tests of attitude reveal

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* The following desiderata in making a selection were noted by Thurstone and Chave: (1) opinions should reflect present and not past attitudes; (2) double-barreled or ambiguous statements should be avoided; (3) statements restricted to a narrow range of endorsers should not be used; (4) each opinion should be such that persons at both ends of the scale cannot endorse it; (5) statements should be free from confusing concepts; (6) slang should be avoided except where it most aptly describes an attitude.

primarily one's passive organization. If, however, an individual were dynamically determined along the line designated by the statement of attitude, the test would doubtless reveal a very strong approval or disapproval. An active communist, for example, would indicate, through such a test, a strong approval of communistic opinion, which was more than a *passive* mental organization. The truth of the matter is that the attitude test cannot make distinctions between passive organization and active determination, unless we assume that differences in strength of approval and disapproval indicate such gradations. This assumption, however, is without adequate grounds for support from available evidence.

Tensions and Their Release. In the continued story or the film, tensions are constantly being built up and released:

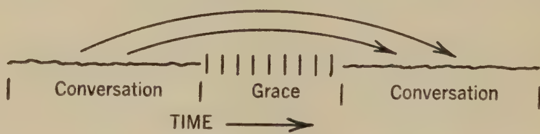
The boy is on a ship; the sea is rough. He slowly climbs the swaying mast to adjust the sail. Near the top of the mast his foot slips; he hangs to the rigging with one hand. He fails to draw himself to safety. Now a rescuer climbs with difficulty the rocking mast. Will the boy's grip weaken? Will he fall to death in the stormy sea? . . .

In listening to narratives such as the above, one feels kinesthetic pressures indicative of uncertainty and perhaps anxiety. When the suspense is released there is a sense of relaxation and letdown. Tensions are experienced, in fact, whenever the outcome of an important situation is uncertain. During an election, suspense or tension is built up while the campaign continues; it reaches its greatest intensity on election day, and is released only when the returns are announced. The release brings joy-elation to some and unhappiness-depression to others, depending upon whether one's wishes are realized or thwarted. The mood which persists after the election gradually wears itself down until a mental balance or poise is restored.

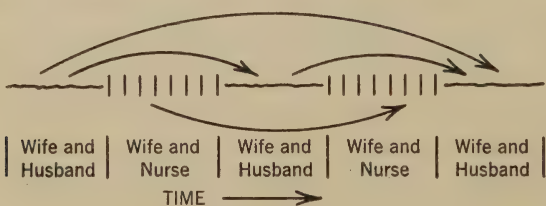
Very clear cases of the tension-release process can be found in the pressures of group conversation. Frequently one feels an urge to make some remark, but speech is inhibited until an appropriate pause occurs. The urge itself feels like some kind of pressure in the throat and mouth region, which indicates that the speech muscles are all set to speak but are prevented from doing so. Later, when

the remark has been made, the inner pressure vanishes. The following examples illustrate the tension and release mechanism in speech.

An interesting table conversation is under way at the start of a meal. *Paterfamilias* who for years has regularly said grace without missing a meal is restless and eager to ask a blessing. His tension is finally released by saying grace. All pause while grace is said, and afterwards the conversation is resumed at the point where it left off. At the close of grace the various speech tensions again seek to find release. From the temporal standpoint the sequence of events and the dynamic relationships may be diagrammed thus:



Again, a man is talking with his wife who is ill in bed. The nurse enters the room and immediately the conversation between husband and wife ceases and a more impersonal one between nurse and wife begins. After a while the nurse leaves the room and the husband-wife conversation is continued from the point at which it left off. The nurse again enters, changing the social situation, and the impersonal talk between wife and nurse is resumed. Once more the nurse leaves the room, again the husband and wife converse. In this situation there are really two conversations which are sandwiched in between each other. Each is more or less of a unit; each depends upon its own motivating factors; each is held in suspense while the other goes on. The psychological situation may be diagrammed as follows:



If a particular conversation pressure does not release itself on the spot, it may gradually wear down and vanish; but there remains for some time a readiness to make that particular remark or to tell that funny story. The untold incident or interesting experience may

bob up unexpectedly at a later time. There is also the phenomenon of being "talked out." Everyone knows that, if conversation is continued long enough, it lags; there is little more to say; everyone has made his remarks and is through, for the moment, with talking. Sleepiness or that quiescence which follows a hearty meal favors the satiation of the urge to talk.

Tension and release occur constantly in the trivial events of daily life. The phone rings; a tension is built up and instantly released by answering the call. An appointment is suddenly remembered; quickly one dashes to the garage and drives away, thus reducing the tension. A resolution to mail a letter, a determination to make a purchase, an urge to give a gift, a wish to read a new book or see a popular play—all build up tension. Frequently a determination is aroused when action is temporarily suspended or delayed. Sooner or later these manifold tensions all find release and fresh ones take their places in the ever-changing situations of daily life.

Bearing upon the analysis of tensions is an experiment of considerable theoretical importance performed by Zeigarnik under Lewin's supervision. The subjects were given a series of agreeable tasks, such as: writing down a favorite poem, molding a clay animal, drawing a vase of flowers to suit the taste, making one's monogram, drawing a map of a small district in the city (Berlin), filling an ellipse with penciled crosses, multiplying, extracting square root, solving riddles, working puzzles, and so on. Eighteen to twenty-two such tasks were given in immediate succession with the general instructions to carry them out as well and quickly as possible. Half of the tasks were interrupted by the experimenter on some pretext or other, but she allowed the remaining half to be carried through to completion.

Completed and interrupted tasks were presented in a haphazard order. After every task the materials used for it were removed from view, and after the whole series had been finished the experimenter asked each subject to tell what tasks had been undertaken during the course of the experimental hour.

The aim of the investigation was to compare the memory for completed acts with that for non-completed ones. The experiment demonstrated clearly that non-completed acts were retained on the average about twice as well as completed ones. The ratio between

the number of non-completed activities retained, and the number for completed ones, was computed for each individual. These ratios for thirty-two subjects are arranged in rank order below:

6.0	2.0	1.5	1.3
3.5	2.0	1.5	1.3
3.3	2.0	1.5	1.0
3.0	2.0	1.5	1.0
3.0	1.75	1.5	1.0
3.0	1.75	1.4	0.8
2.5	1.75	1.4	0.8
2.0	1.6	1.4	0.75

This superior retention for non-completed activities has been referred to as the "Zeigarnik effect." It can be explained, in terms of Lewin's psychology, by reference to a want (*Quasibedürfnis*) on the part of the subject to complete a task once begun. When an activity is interrupted, a tension generally remains which leads the individual to complete it later, if opportunity offers. With the completed task no such tension persists, and hence the degree of retention is less. The psychological principle in question is well recognized in daily life: there is a persistence of determination towards the completion of activities which have been started and temporarily interrupted.

Tensions and their release can best be pictured in terms of muscle tonus. The pressure-like strain or relaxation which an individual feels in his conscious experience is directly dependent upon the bodily set aroused by the situation. The mechanism of tension-release is the same as that involved in getting set for action and later reacting upon the basis of the preparatory adjustment.

The Cessation of Repeated Voluntary Activities. If a subject is instructed to repeat an interesting activity as long as he is inclined to do so, such as tapping out a given rhythm or playing a melody, sooner or later his interest and enthusiasm wane. Finally the person comes to realize that he has had enough of it. If urged to continue beyond the natural stopping point, he shows a negative attitude towards the task and endeavors to escape from the scene of activity.

Karsten, in an experiment under Lewin's supervision, instructed the subjects to tap out a certain rhythm just as long as they were inclined to do so. For a minute or more the tapping went along smoothly, but after a while (the time varying with the individual from five to thirty-eight minutes) the subjects ceased and wanted to get away from the laboratory situation. By reason of repetition, the activity which was at first carried along with moderate interest became one to be avoided. According to Karsten, mental satiation is not the same as fatigue, although the two conditions are closely associated.

If one starts to play solitaire, to work upon a crossword puzzle, to knit, to read some monotonous article, to putter around the garden or workshop, or to engage in almost any repetitious activity in the absence of deep interest, eventually a time arrives when one has had enough. Quite apart from fatigue, sleepiness, and distraction from other compelling activities, the interest in the occupation sooner or later declines. The child plays with one toy for a time and then grows tired of it; he next turns to a new plaything and is engrossed with it for a while, later preferring still a third, and so on. His interest in some toys declines with weeks of habituation to them, but his enthusiasm for others increases under the same conditions. If any individual is urged to continue an activity which has become uninteresting, oversatiation with negative behavior results.

The kind of satiation that depends upon a physiological state, such as satisfying of food hunger by eating, the satiation of thirst with water, and of all urges which are abated by their consummatory reactions, is quite a different process from the type of satiation with which we are here concerned. In Karsten's examples of mental satiation for initially interesting activities, the physiological basis is not clearly apparent. The motivation was furnished by the instruction of the experimenter "to repeat the activity as long as inclined to do so," which instruction determined the subjects voluntarily to continue their laboratory tasks. The interest in the activities was a secondary factor of motivational significance.

Perseveration. Experiences which are vital to us are not instantly forgotten; they tend to recur for days or even for years: a remark made by someone we are eager to make a good impression upon, or by us to him; a song for which we have tender associa-

tions; or an incident in connection with applying for a much-coveted job; or a date with a much-admired friend, etc. These vitally important experiences live on as memories. Their persistence is called perseveration.

Further illustrations of the process can easily be found in daily life. The public speaker who returns home, after delivering a carefully prepared speech, finds himself for hours turning over in his mind the phraseology used in his address, the points he made, the laughs and other reactions obtained from the audience, the persons present, and many such details. The dance or social event of the evening is reviewed late into the night; remarks that were made are repeated over and over; facial expressions, gestures, and petty incidents are relived. The memories of the affair hang on for days, but gradually they wear down as other activities and experiences furnish distraction and crowd them out.

The melody running through one's head is another familiar instance of this phenomenon. A few days ago I heard a symphony orchestra play Tschaikovsky's *Symphony, No. 6, Pathétique.* Since then parts of that symphony have been running through my head, especially the famous *Allégro* in 5/4 tempo. I have repeatedly heard this symphony in the past, and have played parts of it in piano duet form. Clearly, then, there is in my nervous system some organization corresponding to that particular musical pattern; but the organization was idle until this orchestral performance started something going. It is certain that these melodies running through my head will quiet down in a few days or weeks.

The essential features of perseveration are the *persistence* of an activity and its gradual *subsidence*. The perseverating activities are not carried on voluntarily, as in the examples of the previous section, but apparently in an automatic way quite outside the field of volition. Whether one views perseveration as the *persistence* of an activity or as a gradual *subsidence*, the motivational process is one and the same.

There is no conscious determination to continue the activity, as there is in Karsten's examples of mental satiation. On the contrary, the individual often wants to forget, tries to forget the perseverating experiences, and cannot do so. They seemingly run along of themselves until quiescence is at last restored. Superficially considered,

perseveration appears to be a process of tranquillizing an organism which has been in an excited state.

Very little is understood at present about the motivation of perseverating activities. Regardless of the ultimate explanation, the author's hypothesis is that every activity in progress, without exception, is motivated. Every instance of repeated activity which gradually ceases is caused by some continuing and finally subsiding motivating condition.

Lewin explains the persistence of repeated activities and their gradual subsidence in terms of mental tension. That is, within the personality are mental structures which may exist in a passive state or in a state of tenseness. Experiences build up tensions which must then find release. It is much as if there were a certain amount of energy in the mind which gradually dissipated itself, just as a clock, wound up, will run down and remain inert until some one winds it again. The main difficulty with this view is that we do not yet understand physiologically what is meant by mental tension.

Possibly the tension is a persisting state of heightened excitability in the neurons which is brought about by a vivid and subjectively important experience. Possibly it is an actual tension, or tonic state, in some group of smooth or striped muscles, as in postural adjustments. Future research holds the answer.

NEED, DESIRE, CRAVING, WANT, WISH

The psychological conceptions of need, desire, want, craving, and wish are interrelated. They are also closely akin to the conceptions of appetite and aversion (pp. 271-278), though the latter fall more naturally in the chapter upon positive and negative behavior.

Need, Desire, Craving. In a previous section (pp. 80-81) *need* was defined as a condition within the tissues of an organism which can be described objectively, and the term was distinguished from conscious *desire*. Our definition of need is not held to consistently by psychologists, but all recognize the importance of the facts of need and desire.

In the opening paragraph of his *Social Psychology* Allport refers to *need* as follows: "The essential formula for behavior is as follows: (1) Some need is present in the organism, such as the necessity of withdrawing from weapons injuring the body, or the need to ob-

tain food or to secure a mate. The need may also be of a derived and complex order; for example, the necessity of solving some problem upon which the satisfaction of the more elementary wants depends. (2) The organism acts; it behaves in such a manner as to satisfy the need."

Dunlap believes that *desire* is a fundamental category in psychology. Desires are "actual facts in the organism of the same order as the muscular and glandular activities which are classified now as instincts, now as habits." Regarding the physiological basis of desire Dunlap writes: "While we might guess at the tissues in which certain of these desires occur, I do not consider their physiological assignment the matter of primary importance at present." About the same time (1922), however, in a footnote of his *Elements of Scientific Psychology*, he tentatively assigned a tissue basis to nine fundamental desires, suggesting the following relationships:

Desire	Tissue Basis
Aliment (food, drink) Excretion	Alimentary canal and urinary system
Rest Activity	Striped muscles
Shelter	Skin, mucous membrane, and connective tissue
Conformity and preeminence	Circulatory and respiratory systems
Progeny Sex	Sexual organs

He adds that there is some reason to believe that activity of skeletal muscle is important in all desires.

The above classification professes to be based upon anatomical and physiological distinctions, and in this respect it is similar to the classification of appetites. But it appears to postulate desires which have no known tissue basis but which are primarily dependent upon the social environment, such as "conformity" and "preeminence." The tissue basis for these postulated desires is speculatively assumed. Further research will doubtless reveal the bodily states which determine desires, and then relationships which generalize known facts can be described.

When desires are very intense it is customary to speak of them as *cravings*. The intense desires induced by certain drugs furnish

excellent illustrations of cravings. Repeated use of morphine brings about profound changes in behavior. The addict is restless at night and irritable and depressed in the day. As the effects of a dose gradually wear off there may be a sense of weakness and melancholia. The addict may become a liar or a cheat. The craving for morphine has been experimentally induced in monkeys; when deprived of the drug their bodies show agonized contortions and when given it again their manner becomes one of quiescence and peace. The intense yearning which morphine addicts experience depends upon a chemical adaptation within the body, possibly within the nervous system, and the cure when found will doubtless be chemical in nature.

The Wants of Children. The term "want" is another which overlaps the meanings of "need," "desire," and "craving." It is a mistake to assume that these words mark off any very distinct psychological differences. They are, in fact, used interchangeably to a high degree. The distinctive meaning of "want" is the notion of something lacking or absent, *i.e., wanting,* which is sought for.

With all these terms there is a common danger—that of pseudo-explanation of the kind met in careless explanation by instincts. Consider as an illustration a study made by Miss Berne. She observed during 540 hours the overt behavior of seven children, from two to four and a half years of age, and asked always this question: "What wants, implicitly or explicitly recognized by the children, or unrecognized, were the children seeking to satisfy?"

A great many items of behavior in a variety of situations were observed, and from the results a classification of wants was worked out. In their non-social behavior the children appeared to be satisfying primarily the wants for eating, drinking, sleeping, and excreting, and secondarily wants for moving, vocalizing, observing, touching, and quiescence. The social behavior was said to satisfy a great variety of wants. The latter were grouped into six classes, the wants for: (1) aloof observation of other persons, (2) cooperation with other persons, (3) self-conformance (to conform to the behavior patterns of others), (4) others' conformance (to have others act like one's self and agree with one), (5) self-determination (to make one's own decisions without interference from others),

and (6) self-superiority (to be more successful and competent than others).*

The weakness of such classifications is the lack of an objective criterion of want. Miss Berne writes: "The behavior patterns of eating, drinking, sleeping, and excreting satisfied respectively the primary organic wants for eating, drinking, sleeping, and excreting." Again: "Talking, yelling, screaming, clucking, jabbering, squawking, squealing, humming, whispering, grunting, 'reading,' 'counting,' weeping, and laughing, grouped under the pattern of vocalization, seemed to be satisfying the want for vocalization." In these examples the conception of want adds nothing to the bare statement that the child acts in the specific ways mentioned. To say that the child *wants* to eat, tells nothing about the bodily mechanisms of food hunger. One can equally well say that the child eats because he has a faculty, an instinct, or a propensity for eating!

A number of years ago the writer made some observations upon the wants of children. Children are excellent subjects for studies of motivation because they express wants quite openly and with little of the subtlety, finesse, and inhibition which are present with adults.

The method was merely to observe all bits of behavior which seemed indicative of want and to write the facts on an index card as soon as possible after the observation. In no case did the child know he was being observed. In this way numerous incidents were recorded upon several children.

No attempt was made to classify wants or desires. The question asked was merely this: "What do the records tell about the psychological nature of want and desire? How can the psychological problem of want be formulated?"

A number of the records are reproduced below to illustrate principles involved in behavior which manifests wanting.

1. A boy, five years old, and his brother about three are seated side by side in the dining car of a train. One plate of ice cream is between them. The older boy takes this and holds it to one side where the smaller boy cannot reach it and then starts to eat. The

* Material in parenthesis has been added by the author.

smaller boy stretches out both hands toward the plate but fails to touch it. He turns to his mother and cries loudly.

2. In the above situation the smaller boy dips his hands in the finger bowl. He then reaches over and uses the finger bowl of his brother, then his own again. His mother moves the finger bowl out of reach. He reaches toward it; he stands on his chair and again reaches. His mother takes him by the arm and starts to leave the dining car. He cries, holds back, reaches with one hand toward the table. Finally he throws himself down upon the floor and cries. His mother picks him up and carries him out, still crying.

3. Jimmy, aged seven months, is in a baby carriage. He makes up-and-down movements with arms and legs. One hand grasps the side of the carriage, and he pulls himself part way up to a sitting posture and then falls back. There are more slashing movements, and again the baby pulls himself part way up and falls back. Mrs. D, observing the behavior, comments: "He *wants* to sit up."

4. Teddy, aged five years, is left inside the house at the beach while his father and mother prepare to leave in a rowboat. Through the window he sees the boat and all the preparations for departure. He says, "I want to go." He tries the front door and finds it locked. Then he runs to the back door, still crying, and around the house to the water front. As the boat starts he says, "I want to go, Mama; I want to go." He continues crying as the boat leaves and wades out a few feet into the water. He runs along the shore beside the boat and finally has to be carried crying into the house.

In the above examples *want* is behavior directed toward some objective. There is a specific determination "to eat ice cream," "to play with a finger bowl," "to sit up in a baby carriage," "to go for a ride in the boat." It is because these determinations are blocked that the want is apparent. The want expresses itself: (*a*) by persistent behavior directed toward the objective, (*b*) by crying, (*c*) by resisting any change which removes the individual farther from the objective, (*d*) by aimless movements, (*e*) by verbal behavior in which the word "want" or its equivalent is used, (*f*) by taking a detour to the objective. The taking of a roundabout path (detour, *Umweg*) to reach the objective, as when Teddy in example 4 went directly away from the boat to the back door of the house and then around to the water front, is a well-known characteristic of human and animal behavior. This type of behavior has been noted especially by Köhler in his studies of the behavior of chimpanzees.

5. Sally, aged seven years, at supper: "I don't want any beans."

Q: "Why don't you want them?"
S: "Because I don't like them."
Q: "Why don't you like them?"
S: "Because I don't."

6. Vivian, aged five: "I want to go upstairs and see John."
Q: "Why do you want to see him? He's working."
V: "I want to see him work."
Q: "Why do you want to see him work?"
V: "Because I want to talk to him."
Q: "Why do you want to talk to him?"
V: "Because I want to."
Q: "But why do you want to?"
V: "Because . . ." (no further answer).

7. Marian, aged eight years:
Q: "Suppose some one should say, 'I'll give you everything you want,' what would you say?"
M: "Would it be Mother or some stranger who asked?"
Q: "Suppose your Mother should say, 'I will give you every thing you want,' what would you ask?"
M: "You just want to hear me talk."
Q: "Well, I'm not going to give you anything now but suppose your Mother would."
M: "I want a little Bible with pictures in it." (The family are Quakers and religious.)
Q: "Suppose you had the Bible, what would you want next?"
M: (Named several kinds of flowers and asked for a bunch of each; the scene was in a garden.)

8. *Q:* (out of a clear sky): "What do you want?"
Teddy, aged five: "Nothing" (playing with a tin horn).

Examples 5, 6, 7, and 8 are typical results of an attempt to question children about their wants. In general, the method is futile. To the child, wants, likes, desires are ultimate; when expressed verbally there is little more to be said. The question "Why?" simply brings a reiteration of the want. Persistent questioning may make the child suspicious (example 7). Example 8 is interesting. The child playing happily with his toy replies that he wants nothing. If, however, he were deprived of his toy in order to wash his ears or dress, there would doubtless appear an emphatic want to continue playing.

9. Tommy, five years and seven months, at the breakfast table.
His mother: "Tommy, eat your mush."

Tommy: "I don't want to." (He makes squirming movements with arms, shoulders and hands; he is restless.)

10. Tommy brings pencil and paper to the breakfast table. His mother: "Now sit up here and eat your breakfast."

Tommy: "I don't want to eat; I want to draw."

His mother repeats the request. Tommy whimpers and starts to draw.

11. Tommy is in the parlor and his mother starts to take him upstairs to bed. Tommy: "I don't want to go to bed."

He throws his arms and legs about, cries. He is taken by the arm and led toward the staircase and up. He resists every step and holds back as if determined not to go but rather to stay down.

12. Tommy arrives in an auto in time to see his brother cross the street and go toward a rowboat at the water's front. He attempts to get out of the auto before it has stopped, but is held back. He says: "I want to go."

He makes struggling movements and then starts to cry while his mother holds him. After the auto comes to a standstill he gets out and runs to the boat.

Examples 9, 10, 11, and 12, observed within a period of two weeks on the same child, indicate that, when a want is blocked, aimless movements are likely to occur. In the first three of these cases, *not wanting* to do something appears when a determination to do something else is disturbed.

13. Dorothy, aged twelve, spends much time reading books, and her parents do not wish her to become over-bookish. One day her father suggests taking a walk down the beach.

Dorothy: "I don't want to go."

Her father starts and asks her to come along. Dorothy holds back, finally starting, but staying decidedly in the rear. She walks slowly as if determined to remain at home. The following conversation occurred between the writer and Dorothy.

Q: "Do you want to come?"

D: "No."

Q: "Why don't you want to come?"

D: "I don't know."

Q: "Is there anything else you want to do?"

D: "Yes, I want to stay home and read." (She laughs.)

The situation described in example 13 with minor variations occurred repeatedly. The verbal suggestion "Let's take a walk" was

not effective in creating a want to walk, for Dorothy was determined to continue reading and to live in her world of phantasy; the determination was firmly established.

14. Three children had been promised a ride in a speedboat. Then they were told they couldn't go. This brought crying and obvious disappointment expressed by a general downcast manner as well as verbally. Later they were told they could go; at this they jumped vigorously up and down, making vocal cries expressing delight. In a good many other cases of our record the attainment of something desired was seen to bring obvious joyful behavior.

15. The following has been given me by E. E. Anderson:

"The little girl at my rooming house (aged one year, eleven months) seems to enjoy my company and I often stop to talk to her a few minutes. When I turn to go and tell her goodbye, she often says 'Don't go,' and runs and shuts the door if it is open. If already closed, she leans up against it to hold it shut. My usual procedure is to open the door gently and go out, but she has never cried."

Anderson comments: "I think it is legitimate to interpret this behavior as the expression of want, but there is apparently no gross blocking of the child's activity, and no crying." It seems to the present writer, however, that the incident does involve blocking of activity. It demonstrates clearly that thwarting does not always lead to crying, and this fact suggests the desirability of a study of the conditions under which crying does and does not occur.

All the above illustrations of wants in children have one feature in common: there is a specific determination to act, combined with circumstances which prevent this determination from operating freely. It is the blocking or inhibition which creates the want, or at least which makes it apparent in the behavior of children. Hence an analysis of want should be integrated with the study of specific determinations.

The Freudian Wish. In Freud's psychology and in the dynamic psychologies which have grown out of it or been influenced markedly by Freudianism, the conception of the wish plays a dominant rôle. In popular psychology the wish is typically a conscious desire or want for something which is lacking. In psychoanalysis the wish is a "motive force which determines the flow of dynamic

mental processes to seek discharge of their tension, without necessarily implying awareness of the motivation."*

The implication that a wish may be at times unconscious and still a motivating factor goes contrary to popular usage, but it fits in well with sound doctrines of determination as set forth in this book. Indeed, some doctrine of unconscious motivation is essential to any adequate psychology.

Freud, as every magazine reader knows, has set forth his view that day-dreams are wish fulfilments in phantasy, and that night dreams are also imaginary fulfilments of unrealized wishes. This is especially obvious in children. The child wants a toy and dreams he possesses it. With adults there is generally a censorship which prevents the true and complete expression of a wish, but the wish crops out nevertheless in symbolic or distorted form.

It has been told that the men who went to the North Pole with Peary and who were forced by circumstances to live on pemmican and the simplest Arctic Zone diet, repeatedly dreamed of the delicacies of New York restaurants. In their sleep they smoked fine cigars and drank highballs. The dreams gave a substitute satisfaction, an imaginal wish fulfilment.

Mistakes of speech, according to Freud, are often motivated by some wish. Dr. Brill has illustrated this by relating a story told by a patient. She had attended a dance that continued until about 11 P.M. At that time everyone present expected a substantial repast, but instead only sandwiches and lemonade were served. The guests were all disappointed, but politely suppressed the symptoms of their true feeling. At the time, Theodore Roosevelt was running for president, and one of the guests while discussing politics with the host expected to say: "There is one fine thing about Teddy, he always gives you a square deal." Instead he concluded with "a square meal," much to the embarrassment of all.

Wish fulfilment, according to Freud, is also illustrated by the breaking of objects we heartily dislike, and by the losing or misplacing of things we really do not want. Rubbers, umbrellas, and other nuisances are commonly lost. On the other hand, it is a high compliment to the host for a guest to leave behind him a handbag,

* Warren, H. C. *Dictionary of psychology*. Boston: Houghton Mifflin, 1934. Pp. x + 372. (Second definition of *wish*.)

handkerchief, or other valued object because this indicates a wish to return. Although there is doubtless truth in this Freudian doctrine, it is not difficult to recall exceptions. Many valued articles have been lost and broken; many mistakes in speech depend on fatigue or distraction rather than a wish.

Sexual wishes become suppressed by antagonistic attitudes derived from the social environment. Ideas of purity, decency, morality, sin, and the like, are built up gradually in the individual through processes of education in home, school, church, and elsewhere. Mental attitudes and determinations thus acquired may suppress the free biological reactions of sex. This is likely to lead to perversions and in more unstable individuals to induce neurotic symptoms. The word "prudery" describes attitudes and behavior antagonistic to the natural sexual wish.

In a book which bears the title of this section, Holt has developed a physiological interpretation of the Freudian wish. The wish, he points out, is *embodied*. It is a determination for some course of action which the bodily mechanism is capable of carrying out. In other words, the wish physiologically is a specific determination, whether or not the individual is clearly aware of it. Holt has described it as a "motor attitude."

It is probably true that the range of facts explained by the Freudian wish can be adequately accounted for in terms consistent with known bodily mechanisms. Sublimation, for example, can be described as a reorientation of the individual, a changing of his goal-sets in accordance with well-known principles of motivation. Repression can be interpreted in terms of inhibition or thwarting of determinations. Unconscious wishes can be regarded as bodily sets. The scientific account of motivation deals to a large extent with unconscious determinants.

Summary and Conclusion. Behavior is directed and regulated by bodily postures—whether grossly apparent or imperceptible—and by inner neural sets which are the bodily counterpart of conscious purposes and desires. The adjustment of an individual to his task involves a variety of interrelated factors, a number of which have been studied experimentally. Among these are: the subject's understanding of the nature of his task, his method of working, the visual and other sensory guidance which he may utilize in carry-

ing out an activity, his preparatory set as established by the quantity of the work initially presented, a knowledge of the results of his work, and a group of factors which go to make up what is commonly called "attitude," such as enthusiasm, interest, and self-reliance.

Behavior is constantly limited and restricted by the bodily structure of the individual. This structure includes gross anatomical formations of the nervous system and acquired neural organization, especially that which determines verbal behavior. This neural structure not only restricts behavior within certain limited channels; it also opens up new possibilities in the way of future activities.

Neural structure may be latent, or it may be dynamically active. A distinction must be drawn between *latent organization* and *dynamic determination*, and this distinction is valid whether the problems of motivation be approached through a study of behavior and its physiological basis, or through an analysis of conscious experience and its conditions. Class-room tests of knowledge and psychological measurements of attitude are aimed at diagnosing mental organization.

A dynamic determination may be highly specific—a set to carry out a particular act, as, for example, to mail a letter; or it may be a very general readiness, as an inclination to converse upon some topic. The various facts of determination can be described also in terms of mental tension and release.

Needs, desires, cravings, wants, and wishes are all commonly regarded as motivating factors and are all interrelated. They are also closely allied to appetites and aversions, which will be considered in the next chapter.

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CHAPTER VI

POSITIVE AND NEGATIVE BEHAVIOR

"Paramecium at times accepts things that are useless or harmful to it, but perhaps on the whole less often than does man."

—H. S. Jennings

Positive and negative behavior occurs in every form of life from man and the most highly developed animals all the way down to the protozoa. Some activities of seeking or avoiding are brief and simple; others are persistent and complex.

POSITIVE AND NEGATIVE REACTIONS

Examples of Simple Acceptance and Rejection. Looking first at the simplest forms of life, let us examine some single-celled organisms and see how they react both positively and negatively to stimulations from their environmental fields. Illustrations of their positive and negative behavior are presented in Fig. 54.

The positive reaction of an ameba is shown at *A*. In moving through the water this micro-organism thrusts out pseudopodia simultaneously in many directions. If the tip of a pseudopodium happens to come in contact with the surface of a solid body, behavior at once changes; the tip attaches itself to the surface, and the protoplasm of the cell flows into this attached part. Other pseudopodia are withdrawn, and the protoplasm gathers itself together into a compact and somewhat flattened mass. After this, the ameba creeps slowly along the surface. An avoiding response is illustrated at *B*. When an ameba, advancing in the direction shown by the arrows, is stimulated by the tip of a fine glass rod at its anterior edge, this part of the cell contracts and the protoplasmic currents are redirected away from the rod, fresh pseudopodia thrusting themselves out in new directions.

Turning now to the paramecium, we observe that negative behavior is clearly evident. If a paramecium in swimming forward

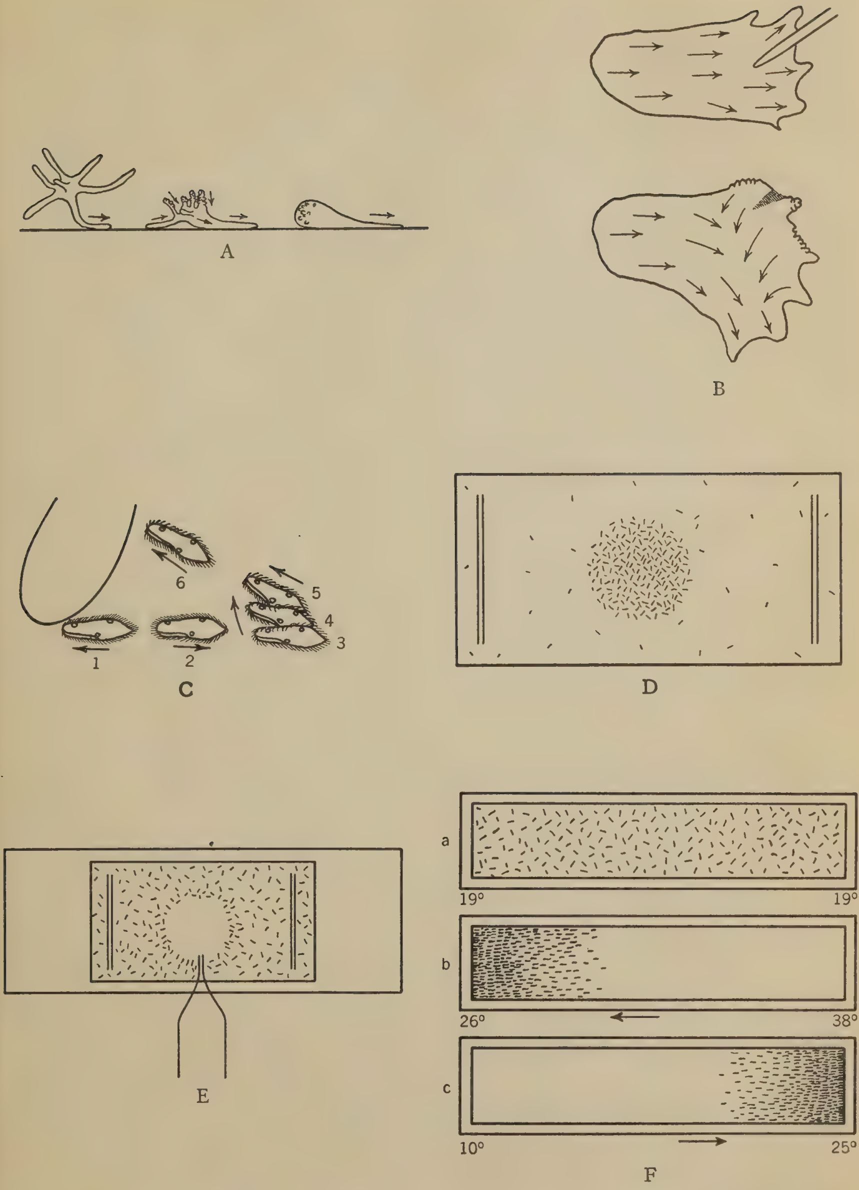

FIG. 54. POSITIVE AND NEGATIVE REACTIONS OF PROTOZOA. (*After Jennings, explanation in text.*)

comes in contact with a solid body, it reverses its ciliary action and swims backward, as shown at *C*. Turning a bit, the animal again swims forward, occupying in this avoiding response the successive positions indicated by numbers 1 to 6. If this time it comes in contact with a solid body as before, the whole process is repeated until finally the obstruction is cleared. Once again, when a drop of one-fiftieth per cent acetic acid is introduced by pipette onto a microscope slide which has paramecia on it, the organisms collect in the drop, as shown at *D*. They enter without an avoiding response, and once inside remain there, giving their negative reaction at the surface of separation between the drop of acid and the water. Just why they fail to penetrate the surface of the acid drop and thus escape is difficult to say. Eventually most of the paramecia on the slide are to be found collected inside the drop of acid, which acts like a trap. Superficially the reaction appears to be a positive one to the drop of acid, but actually it is a negative response to the inside of the surface of separation.

When, however, a drop of one-half per cent sodium chloride is introduced by pipette onto a similar microscope slide, the paramecia remain outside of it. They give their avoiding reaction this time at the outer surface of the drop, as illustrated at *E*.

The pictures at *F* represent the behavior of paramecia in relation to water temperature. The first drawing (*a*) shows the infusoria placed in a trough of water, all parts of which are heated evenly to 19°C. Under these conditions they are uniformly scattered throughout the water. The temperature of the water in the next trough (*b*) has been raised to 38° at one end, while at the other end it is only 26°. The paramecia are seen collected at the end with the lower temperature. In the third trough (*c*) the water has been warmed to 25° at one end, while at the other it has been lowered to 10°. Under such conditions the animals collect at the end of the thermal gradient having the higher temperature; this temperature is nearer to the optimal level for paramecia.

Transferring our attention now to a less primitive species, we consider the newborn rat. Two excellent illustrations of positive and negative behavior are contained in Harlow's account of the reactions of this animal to tactual and thermal stimulation. The neonate, if placed in contact with cotton, wool, or some other soft, furry

object at room temperature or above (23°-50° C), crawls forward and underneath the neighboring material. This approaching activity—a positive reaction—is related to the act of crawling under the body of the mother as in nursing or for protection.

An example of negative reaction is found in a feeding experiment of Harlow. If young rats are fed with a medicine dropper, the gain in weight during the five-minute feeding period measures the quantity of food ingested. Proceeding on the basis of this fact, Harlow fed eight nine-day-old rats with whole cow's milk at five different temperatures. The average gain in weight was:

	10°	20°	30°	50°	70°
Average of Gains......	13.8	92.5	117.5	42.5	0
Sigma................	12.1	20.2	17.3	30.3	..

Incidentally, these figures show the importance of thermal conditions in regulating the quantity of food eaten. Most milk was ingested at a temperature of 30° C, whereas at 70° C this food was completely rejected. This clearly illustrates positive and negative reactions to food on the basis of its temperature.

Beneception and Nociception. An organism generally inclines to accept foods that are good for it and to reject those that are harmful. Also it tends to avoid injury and all stimulations which damage the tissues. It is prone to reproduce, to feed and care for the young, in these ways furthering the expansion and continuity of the species. There is not necessarily, on the part of the organism, any conscious foresight of the consequences of behavior, but by and large, living creatures do act so as to preserve themselves and their kind. Philosophers have explained this by postulating instincts of self- and of race-preservation. The weal-and-woe doctrine has been reformulated by Troland, who coined the words which head this section. His definitions follow:

Beneception—A process in a sense-organ or afferent nerve channel which is indicative of conditions or events that are typically beneficial to the individual or species.

Nociception—A process in a sense-organ or afferent nerve chan-

nel which is indicative of conditions or events which are typically injurious to the individual or species.

NEUTROCEPTION—Any kind of sensory process which is neither beneceptive nor nociceptive.

As examples of beneception Troland mentions: erotic excitation; gustatory stimulation from sugars (for the detection of carbohydrate substances which furnish the essential fuel for muscular activity); olfactory afferent responses to the ethereal, aromatic, and balsamic odors which are indicative of the presence of fresh vegetable products useful as food; the tactual feeling of warmth which indicates the proximity of heat energy needed in cold environments to restore the temperature equilibrium of the body. Troland suggests the following as examples of nociception: pain excitation from damage of the tissues; organic stimulations from such bodily conditions as hunger, excessive heat or cold, need for air or water, need to micturate or defecate, etc. These bodily stimulations indicate the existence of conditions which are detrimental to the integrity of the organism or the species. A bitter taste frequently bespeaks the presence of poisonous, alkaloidal materials which are dangerous to life. Salty- and sour-tasting substances are nociceptive at high intensities. The alliaceous, caprillic, nauseating, and other repugnant odors identify materials as unwholesome or injurious if used as foods. Finally, neutroceptive processes are illustrated by sensory reactions—neither beneficial nor harmful—which occur in perceiving weak noises, colors of medium brilliance, indifferent odors, and so on.

Troland's criterion of nociception and beneception is biological survival. Organisms have gradually evolved in such a way that in the long run their behavior furthers their survival and that of the species. How this has come about is the involved but fascinating story of biological development.

Troland specifically spurns the traditional biological theory which associates pleasantness with objects and situations beneficial to the individual or species and unpleasantness with those which are detrimental. If the reader will follow through Troland's examples, however, he will discover that the illustrations of beneception definitely suggest pleasant feeling whereas those of nociception suggest unpleasantness. Although the critical student can readily discover

exceptions, such as those found in the spheres of medication and the addiction to drugs, it is generally true that pleasantness is associated with beneception and unpleasantness with nociception. With only a slight stretch of the imagination, one can conjecture with Professor Washburn that even the ameba may have some dim awareness of pleasantness associated with positive reactions and of unpleasantness associated with avoidances.

APPETITE AND AVERSION

Two-thirds of a century ago Bain wrote that appetites are *"the cravings produced by the recurring wants and necessities of our bodily, or organic life."* He mentioned the demands for *"Sleep, Exercise, Repose, Thirst, Hunger, Sex,"* as "the appetites most universally present throughout the Animal tribes." The appetites of exercise and repose, he wrote, vary with the condition of the muscles. A fresh, *i.e.,* rested, condition of the muscles stimulates a desire for action which, if checked, gives a feeling of intense uneasiness. Similarly after vigorous exercise there is a powerful craving for rest. Had Bain made a more thorough canvass of bodily needs, he doubtless would have added others to his list, such as the appetites for defecation, micturition, and lactation.

Bain recognized that the basis of appetite was found within the body. For him, as for most people today, an appetite is a conscious craving based upon a bodily state and associated with a positive inclination. An aversion, similarly, is a conscious experience associated with an impulse to avoid something.

Along with the development of objective methods in psychology all processes have come to be viewed as behavioral or as physiological activity. Objectively considered, then, *appetite* and *aversion* have come to apply not at all to conscious experiences, as such, but rather to bodily activity. Appetite is thus revealed as a persistent positive relation between organism and goal object; aversion as a negative relation. This view can best be set forth by drawing from the writings of Craig.

Appetite and Consummatory Reaction. For Craig, *an appetite (or appetence) is externally observable as a state of agitation which continues as long as the appropriate stimulus object is not attained or withheld.* When this stimulus object is received a con-

summatory reaction occurs, after which the appetitive behavior ceases; and a state of relative rest ensues.

Appetite is shown by a readiness of the organism to act, which readiness appears even before the appropriate stimulus object is encountered. For example, doves learning to drink make incipient drinking reactions when water is brought to the cage before they can get it. Again, during the nest-building period doves show an innate tendency to pick up straws and another tendency to build them into a nest, even when the reactions have no relation to building a particular nest. The apparent readiness for particular reactions to occur is accompanied by a relative unreadiness for others. This does not mean an aversion, however; a true aversion is not merely unreadiness; it is active avoidance.

Aversion is a state of agitation which continues as long as a certain disturbing stimulus object is present, but which ceases and is replaced by a state of relative rest when the disturbing stimulation ceases to act. A good illustration of aversion is found in the jealous behavior of the male dove. If a male sees another dove near his mate, he either attacks the intruder with real pugnacity or gently drives away the mate.

Often there is a struggle between two appetites, as when a bird hesitates between going to the nest to incubate eggs and going away to join the flock. Craig states that he is able by watching a bird to predict which line of behavior will be followed, because each appetite has its own distinctive signs. The conflict may last for a considerable time and one can tell which of the opposed appetites is gaining control of the organism by watching the bird's reactions.

In the dove the appearance and satisfaction of an appetite, according to Craig, constitute a cycle with four stages, as follows:

1. In the absence of the appropriate object ("appeted stimulus") there is a state of agitation, a restlessness, revealed by increased muscular tension, varied effort, and assuming of postures and actions which are easily recognized as incipient consummatory reactions, betraying the appetite or aversion aroused.

2. Reception of the "appeted stimulus" brings about the consummatory reaction and a state of satisfaction in which there is quiescence.

3. The process of satiation may go to the point of surfeiting, in which event an aversion or avoidance appears in behavior.

4. There is a return from avoidance to a stage of freedom from the activity. This completes the cycle, and the dove is quiescent until the appetite is again aroused by inner physiological conditions.

Inventories of Appetites and Aversions. The list of appetites and aversions differs from species to species. An appetite for incubating eggs, for example, is obviously limited to egg-laying organisms when in a particular physiological state. In conscious terms —as William James put it—"To the broody hen the notion would probably seem monstrous that there should be a creature in the world to whom a nestful of eggs was not the utterly fascinating and precious and never-to-be-too-much-sat-upon object which it is to her."

Various inventories of human appetites and aversions have been made. A recent one is that of Troland. In listing the fundamental appetitions, which he refers to as "appetitional instincts," Troland mentions:

Hunger.
Nausea.
Thirst.
Aversion to pain.
Thermal appetitions (avoidance of extremes of heat and cold).
Respiratory appetition (desire for air).
Erotic appetition.
Excretory and secretory desires, including:
- (*a*) Desire to micturate.
- (*b*) Desire to defecate.
- (*c*) Desire of the mother to nurse young.

General desires, including:
- (*a*) Unrest, desire for change or novelty (as seen in "nervousness").
- (*b*) Fatigue, desire for rest.
- (*c*) Sleep.

An important point about the above list is that every appetition has a physiological counterpart which distinguishes it from the others. In most cases the bodily basis can be described definitely

and in considerable detail; in the case of general unrest and in the craving for sleep there is still uncertainty as to the bodily basis.

Troland has intentionally omitted certain appetitional instincts which lack a known bodily mechanism. The so-called instinct of "flight" is linked with the avoidance of pain; "disgust" is related to nausea. In questioning McDougall's well-known instinct doctrine (pp. 162-165) Troland writes: "The alleged 'instinct of self-abasement' has no simple foundation, but depends upon the interplay of social conditions and a number of fundamental appetitions. The same proposition applies to the alleged 'instinct of self-assertion.' Whether a man or animal is 'self-abasing,' or 'self-assertive' will depend upon which of these types of reaction is successful in providing his organism with food, sex gratification, relief from pain, etc. . . ."

Now it must have occurred to the reader that the conception of appetite and aversion is inextricably bound up with the doctrine of drive and inclination (pp. 145-160). Inventories of appetites and of drives are strikingly alike. Compare Troland's list, for example, with the drives mentioned by Dashiell:*

Hunger.
Sex urge.
Urge for maintenance of bodily temperature.
Thirst.
Urge from distended condition of bladder.
Urge from distended condition of colon.
Urges from conditions in striped musculature.
  (*a*) Fatigue of striped musculature (urge to cease activity).
  (*b*) Rested physicochemical condition of muscles (urge to some kind of muscular exercise).
  (*c*) Tendency to follow a rhythm.
Respiratory drive (as in suffocation).
Avoidance of noxious stimulation to skin.
Sensitive-zone reactions (reactions to stimulation of lips, armpits, and other sensitive parts).

* The first three on the list are treated at length and the rest are discussed briefly under the heading: "Other organic sources of drive." There is, we might note, an ambiguity in the term "drive" as Dashiell uses it. "Drive" is: (1) tissue condition or tissue need; (2) behavior based upon (1). These two meanings, or aspects of drive, must be kept apart by the student of motivation, for both are frequently met in the experimental literature.

Reactions of sensory apparatus and associated motor tissues (observant and curiosity behavior).

Dashiell's account of drives and Troland's discussion of appetitional instincts were published the same year. The two lists have marked similarity—and why? The answer is that both psychologists turned to the tissues and to bodily mechanisms as the basis for classification; both accepted the same physiological criterion and the same objective approach to the problem. Whatever differences exist between the lists can sooner or later be adjusted on a factual, observational basis.

Another list, that made by Tolman, presupposes a somewhat different attack upon the problem. His approach is on the behavioral, rather than the intraorganic level. The behavior of organisms, considered as molar, has properties of its own, which are not deducible from a detailed knowledge of physiological processes any more than the properties of water can be deduced from knowledge about its molecules.

Tolman has listed the following human appetites and aversions:

Food hunger.
Sex hunger.
Contact hungers (minor appetites which Freud believed to be linked with sex, *e.g.*, thumb-sucking, bed-wetting, feces-holding).
Excretion hungers.
  To micturate.
  To defecate.
Rest hunger.
Sensory-motor hungers (esthetic and play hungers).

He states that there appear in man only two outstanding aversions:

Fright (avoidance of pain or injury).
Pugnacity.

Tolman writes: "The ultimate motivators of all behavior—save, of course, the pure reflexes and tropisms, which do not fall under the head of behavior *qua* docile—are, we assume, certain innately provided appetites and aversions. These consist in ultimate demands to get to final physiological quiescences (appetites) or from final physiological disturbances (aversions). Given certain initiating

physiological states which occur cyclically in the case of the appetites but are relatively constant and continuous in the case of the aversions, the organism is possessed of the demand to get to given types of physiological quiescence (appetite); and to keep away from given types of physiological disturbance, when these latter 'threaten' (aversion). . . ."

The basic difference between Tolman's classification of appetites and aversions, and the foregoing classifications made by Troland and Dashiell, lies in the fact that Tolman is contented with behavioral distinctions whether or not they can be physiologically grounded, whereas Troland and Dashiell list as fundamental only those processes which can be differentiated on the basis of organic tissue conditions.

Appetites and Aversions in Relation to Bodily Processes. When an animal steps upon a charged grill and receives a continuing electric shock he moves to escape the source of painful stimulation. This is an aversion. Physiologically, the pain-avoiding process is one of excitation of peripheral nerve endings, of the propagation of neural impulses, and of reflex responses which withdraw the creature from the grill.

Compare this pain-aversion with the appetite for water. When an animal is thirsty there arises in the parched mouth and throat region persistent stimulation of peripheral nerves. The excitation of the free nerve endings reflexly raises the general activity level. In the case of thirst, however, the animal cannot run away from the source of painful stimulations. To remove thirst he must seek water. Water-seeking, of course, is positive behavior which must be classed as appetitive activity.

It will be seen that both the avoidance of painful stimulation from the grill and the seeking of water by a thirsty animal are the same kind of process, physiologically. Both depend upon stimulation of peripheral nerves which mediate pain and pressure sensation; both release energy reflexly; both lead to behavior which tends to remove the source of painful stimulation.

The only obvious and outstanding difference between the two processes is that in the avoidance of an electric grill the stimulation of the nerve fibers for pain originates in the environment, whereas in water-seeking it comes entirely from the tissues. Water-seeking

might equally well be called thirst-pain-avoidance, and pain-avoidance might in turn be described as the seeking of safety and comfort.

This discussion clearly brings out the fact that the distinction between appetite and aversion is important only on the behavioral level; physiologically it is not fundamental. That is to say, positive and negative behavior exists only from the behavioral point of view and only when the dynamic relationships between an organism and the stimulus objects of his environmental field are considered. These relations do not enter the picture when we restrict our analysis to those processes which go on within the nervous system itself.

Beyond doubt, behavioral distinctions can be made which are impossible on the basis of tissue conditions alone. The terms *appetite* and *aversion* are useful to designate persistent positive and negative behavior. They are also of value, in individual psychology, to describe the conscious experiences of striving to get toward or trying to get away from something.

Incentive Character of Environmental Objects. Lewin has developed a plan of designating incentive objects in the environmental field by marking them with plus and minus signs. If a child moves towards a toy with outstretched arms, this object is rated as having for the child a positive valence. If he moves away from a dog, the animal possesses a negative valence. These positive and negative valences can be pictured in relation to the subject, as in Fig. 55. Together they are used to designate the incentive character (*Aufforderungscharakter*) of objects.

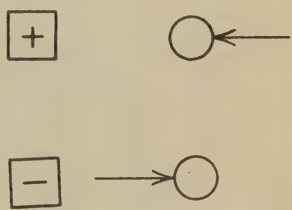

Fig. 55. Positive and Negative Valences. (*After Lewin.*)

The plus and minus signs in the square designate the valence, or incentive character, of the objects. The circles symbolize the subject. The arrows are vectors representing strength, direction, and point of application of environmental "field forces."

Incentive character is something which in many cases changes very quickly with a shift in the environmental situation or with change in the inner needs of the subject. This changeability of valence is much more marked in relation to young children than to adults. On the other hand, incentive characters are sometimes relatively stable, as in the case of valences which are dependent upon a persistent appetite or aversion.

Lewin's manner of picturing valences and field forces is highly intriguing, especially when it is extended to the analysis of complex situations which involve diverse valences, and corresponding conflict. It should be regarded—and Lewin intended it to be—as a means of representing the facts rather than as a principle of explanation.

PUNISHMENT

If a child strikes another, the latter strikes back. If an animal bites another, the latter bites or fights in return. When a man is injured he seeks vengeance. The biological principle of self-defence is something basic in nature. An eye for an eye; a tooth for a tooth. This is the primitive principle of retribution. If the injured person is unable to take revenge, some member of his family or tribe seeks it for him, even if this requires many years.

Punishment in our prisons is still in good part based upon this primitive code of justice. When a kidnaping for ransom has been perpetrated, the public demands that some injury be inflicted on the guilty person. A lynching illustrates the same principle.

The greater the injury the greater the punishment demanded, and so man has used various pain-inflicting devices. The history of penology presents a hideous picture of torture, imprisonment in the dungeon, flogging, stoning, crucifying, and other drastic forms of violence which have been used to regulate and control human behavior. Milder forms of punishment—whipping, spanking, reproof, restriction of freedom, fool's cap, and so forth—have been used from time immemorial in home and school for the social control of children and to motivate learning.

What constitutes punishment? From the individual standpoint, punishment is typically unpleasant and frequently painful; but unpleasant feeling also results from conditions not regarded by anyone as punishments, such as catching the hand on a thorn or falling on the ice. Ordinarily we speak of punishment when unpleasant feeling is deliberately aroused as a means of controlling behavior. However, the psychological effect of an unpleasant reaction is often the same whether the reaction was deliberately aroused or whether it resulted from accidental contact with the environment.

Whether or not a given event constitutes punishment is after all

a matter of interpretation. What for one is a natural disaster is for another a punishment sent from Heaven. Although the deliberate infliction of pain for a misdeed is invariably regarded as punishment by the child, other forms of punishment, such as confinement to a room or standing in the corner, are considered as such by one child but not by another.

The Electric Shock as Punishment. Turning now to animals, one finds the whip, the blow, even the verbal rebuke, employed to control their behavior. Whether animals regard these inflictions of pain as punishments is a speculative question. In any event, mild painful stimulation does motivate animals and leads to a modification of their behavior.

The electric shock has been extensively used for animal experimentation. As early as 1895, Elmer Gates, writing in the *Monist*, reported the use of shock for punishment in the training of puppies:

> The hall leading into one room of my laboratory was covered with squares of metal, each square insulated from the others and colored. These squares of metal were connected with an induction coil, with the exception of those of a certain color which were not thus connected. It was so arranged that a dog might jump from one square to another of the same color and thus pass through the entire length of the hall without getting an electric shock. To do this the dog had to discriminate between that color and all the other colors tinted upon the metal squares. An attentive dog after having been shown several times would learn to avoid the slight shock which he would invariably get when he stepped upon the wrong color. . . .

This experiment now has only historical significance. Today the use of the electric shock in experiments upon animal learning and discrimination is so common that an exhaustive account of it would fill many pages.

One advantage of the electrical punishment is the precision with which it can be controlled objectively, and another superiority over other forms of incentive used in the laboratory is its general applicability to all types of organism under diverse conditions. But it should always be kept in mind that the same amount of current affects different individuals to different degrees.

Even so lowly a creature as the earthworm can learn to avoid a passage in which an electric shock is regularly received. This was

demonstrated by Yerkes in a simple T-shaped maze. In one of the alleys of the T-maze Yerkes placed a strip of sandpaper to serve as warning, and just beyond this, an electric grill. When a worm crept over the sandpaper and failed to turn back a shock was received. The avoiding habit when formed was not constant but varied with the physiological state (fatigue, hunger, etc.) of the worm and with imperfectly controlled environmental conditions such as temperature, moisture, and light. The shock has been used with rats, mice, chicks, cats, dogs, and other laboratory animals. In human research, too, electrical punishment has been employed to a considerable extent (pp. 14-16). An example of its use with human subjects follows:

Bunch arranged a maze so that it would give an electric shock through the hand whenever a stylus was pushed to the end of a cul-de-sac. A group of forty students learned the maze with punishment, and a control group of forty learned it with no punishment.

Comparing the two groups, Bunch found that punishment reduced by about 50 per cent the number of trials needed to learn the maze; further, it decreased by about 30 per cent the total time required for the task. In a word, punishment speeded up human maze learning.

Although the learning process as a whole was accelerated, this speeding-up was accompanied by increased caution. This is shown by the fact that the subjects, on the average, spent 34 per cent more time in a single run when punishment was used than when it was lacking—and this in spite of the fact just stated, that the total time required was decreased considerably by punishment.

Another finding is that the subjects in the group working with punishment were more uniform in their performance than were the controls, both in the number of trials needed to learn the maze and in the total time required. In other words, the variability of performance was decreased by punishment.*

The Yerkes-Dodson Law. One of the ancient justifications for the punishment of criminals has been that punishment deters the individual from repeating the act when released. The same argument applies to children and to animals. If a boy has been ignomin-

* It has been found repeatedly that an increased degree of motivation up to a certain point results in a decreased variability of performance.

iously and painfully whipped in a fist-fight he is likely in the future to avoid his persecutor. An animal that has been viciously bitten by another is more cautious about a second attack in the same quarter. When a parent spanks a child for some misdeed the punishment tends to deter him, for a time at least, from a repetition of the act.

All modifications of behavior, whether produced by punishment or through some other motivating device, are by definition instances of learning. What is the optimal intensity of punishment so far as the speed of learning is concerned? This is a question which can be answered by an appeal to experimental data.

One answer to the question is found in the work of Yerkes and Dodson with dancing mice. These experimenters used different degrees of electric shock as punishment. The making of a discrimination between two differently lighted compartments was the problem to be learned. The apparatus used is pictured in Fig. 56.

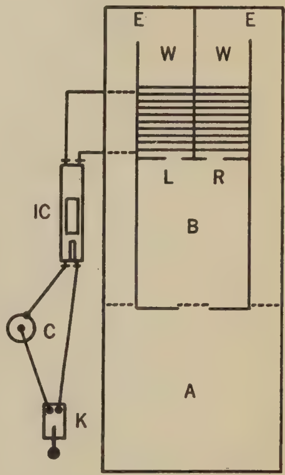

FIG. 56. PLAN OF YERKES' DISCRIMINATION BOX.

B is a choice-chamber from which doors, *L* and *R*, lead into two lighted compartments, *W* and *W*. Exits, *E* and *E*, lead down the alleys to a nest-box, *A*. A wire grid on the floor of the compartments is connected to the induction coil, *IC*. Current from the cell, *C*, is controlled by the experimenter's key, *K*.

Inasmuch as difficulty of the task is one factor in the situation, three degrees of difficulty were tested. In one series a pair of illuminations or visual brightnesses was chosen so that discrimination between them would be very easy—black and white. In another series the discrimination was of medium difficulty—two brightnesses moderately close together were used. The discrimination in the third series was difficult—the brightnesses were very close together.

The mice were required to select one of two entrances on the basis of its brightness. The relative positions of the two fields of light were interchanged in a haphazard manner to prevent habit formation on a spatial basis. If a mouse made the wrong choice, a shock was administered through the grill on the floor; if the right choice, he could return to the nest-box. The criterion of learn-

ing was three consecutive runs without error. After a preliminary brightness-preference test to determine whether there were any unlearned inclinations the training was commenced.

The results are shown graphically in Fig. 57. The base line of the figure gives the strength of the stimulus in Martin units, weak

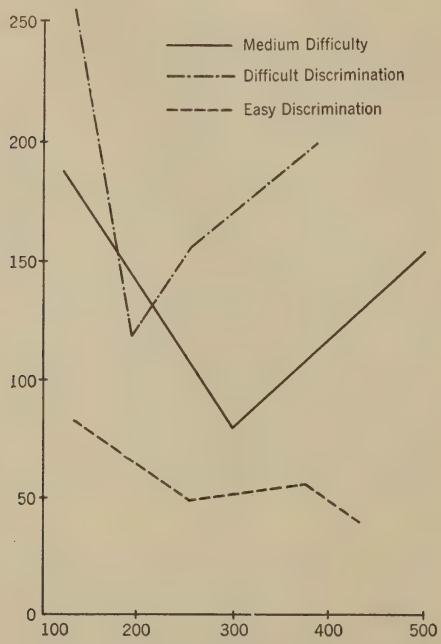

Fig. 57. Strength of Stimulus in Relation to Speed of Learning. (*After Yerkes and Dodson.*)

Base line represents strength of stimulus in Martin units, weak at left and strong at right. Vertical shows total number of trials for four mice necessary to establish visual discrimination habit.

at the left and strong at the right.* The vertical gives the total number of trials necessary to establish the discrimination habit in four mice. The lower curve (dash line) presents the result with easy discrimination; the middle curve (solid line) shows the results with medium difficulty, and the upper curve (dot-dash line), with difficult discrimination.

In examining the curves, if we limit our consideration to the

* Martin units are stimulation units of electrical energy. For details see reference to paper by Yerkes and Dodson, pp. 466-467.

three points plotted at the extreme left of Fig. 57, it appears that the difficulty of discrimination is a very important factor in determining the result. When the brightnesses are widely separated (lower curve, easy discrimination) the habit is readily formed; when the brightnesses are quite close together (upper curve), discrimination is difficult and the habit slowly formed. This corresponds to what one would expect on the basis of common-sense observation. In other words, for a constant motivation the more difficult the task the greater the number of trials needed to learn it.

When, however, we take account of the different strengths of shock stimulation, it is apparent that the three curves vary considerably. With easy discrimination the rapidity of learning increases directly with the strength of the punishment. With more difficult discriminations (upper two curves), an increase in the strength of punishment brings about an initial speeding up of learning, but only to a certain point, further increase proving disruptive to behavior. There is thus an optimum intensity of punishment for a given degree of difficulty of the task, and if the strength of stimulation is increased beyond this optimum, the speed of learning is decreased rather than increased.

Yerkes and Dodson express the principle thus: "As the difficultness of discrimination is increased the strength of that stimulus which is most favorable to habit-formation approaches the threshold." This principle is referred to as the Yerkes-Dodson law.

Although the curves in Fig. 57 do not give enough detail in the critical region to indicate the exact location of the optima, they nevertheless do demonstrate the existence of such optima.

The influence of the intensity of punishment upon the speed of learning was tested with chicks by Cole. When two days old the chicks were given a two-day training period to accustom them to a discrimination apparatus, and after this they were given a brightness-preference test. It was found that untrained chicks uniformly went to the brighter screen. In view of this, Cole determined to train them to select the darker.

In the discrimination apparatus two differently illuminated screens were arranged side by side with a partition between them. Just in front of the screens were exits to the goal-box which was located in the rear. The illumination of the screens was well con-

trolled by lamps placed in light-tight compartments at variable distances behind the screens. By adjusting the distances between the lamps and the screens three degrees of difficulty of discrimination were obtained, designated as easy, medium, and difficult.

A damp felt pad was placed on the floor of the apparatus to moisten the feet of the chicks and assure an adequate electrical contact. Punishment was given through the feet every time a chick went to the lighter screen, and the training was continued until a chick made twenty consecutive choices of the darker screen.

Cole computed the average number of trials needed for a group of chicks to learn the discrimination. From his results the following average values have been selected:

Units of Stimulation	Number of Trials Needed to Learn with Different Degrees of Difficulty		
	Easy	Medium	Difficult
350	44.0	60.0	171.6
480	21.6	40.0	130.0
590	16.6	50.0	53.3

The table of results shows that with easy discrimination the speed of learning increases as the strength of the stimulus increases. With discrimination of medium difficulty an intermediate strength of stimulation gives the quickest learning. The latter result was checked and verified with a second group of chicks. So far Cole's results agree with the Yerkes-Dodson law.

With difficult discrimination and strong stimulation the chicks divided into two groups: (*a*) some after a few trials ceased to try to escape from the apparatus and would not step on the electric wires, and (*b*) others made each choice with greater caution and learned to choose correctly in a small number of trials, each one of which consumed much time. The chicks which made more wrong choices in the early trials and consequently received relatively more pain stimulation than their successful companions never learned the task, because of their negative conditioning to the grill.

Since not all the chicks learned the difficult discrimination with strong punishment, Cole's results are not wholly comparable with those of Yerkes and Dodson. The optimum punishment for the most difficult task was not determined.

A third study bearing upon the principle under discussion was carried out by Dodson. He repeated the brightness-discrimination experiment with a group of kittens. If a kitten went through the lighter compartment, it was allowed to pass undisturbed, but if it attempted to escape through the darker compartment, it received an electric shock and was not permitted to escape. Eighteen six-weeks-old kittens were given ten trials per day until each selected the light box for three consecutive days. Three degrees of difficulty were used, designated as easy, moderate, difficult. There were also three strengths of stimulation: weak, medium, strong.

The average number of trials necessary to form the discrimination habit under the different conditions is given below:

Strength of Stimulation	Average Number of Trials Required for Learning with Different Degrees of Difficulty		
	Easy	Moderate	Difficult
Weak................	75	..	....
Medium............	50	60	82.5
Strong..............	35	55	107.5

With easy discrimination the speed of habit formation increased directly with the strength of stimulation, which corroborates results of Yerkes and Dodson in the experiment described above. With moderate difficulty and the consequent slower learning a similar relationship existed, but it was not so marked. With difficult discrimination a strong stimulation gave *slower* habit formation than one of medium intensity. In this latter case the optimal stimulation was nearer the threshold than in the case of moderate difficulty. So far as these results go, therefore, they are consistent with the Yerkes-Dodson law.

Finally, an experiment made by Vaughn and Diserens with human subjects is *à propos* of this topic because it sheds light upon the extent to which various intensities of punishment affect the rate of learning. These investigators worked with only one degree of difficulty, but they varied the intensity of punishment.

Four stylus mazes approximately equal in difficulty were prepared. The mazes were so planned that whenever a subject pushed the stylus into a blind alley he automatically received a shock. Each subject was given one trial for each of three intensities of punishment and for a condition in which there was no punishment. The degree of punishment can be designated: absent (no punishment), light, medium, heavy.

Thirty-two subjects, divided into two equivalent groups, were given a single trial on each of the four mazes and with each degree of punishment. The total time of a subject between start and finish was recorded. The average time for the groups, given in seconds, was:

Subject Groups	Average Time in Maze with Different Degrees of Punishment			
	Absent	Light	Medium	Heavy
A–P	234.5	192.3	213.9	384.0
AA–PP	375.4	188.7	393.9	415.7

Individual differences were marked, and in a number of cases individual results were opposed to the above averages. Despite this, the figures demonstrate that with light punishment the maze was traversed definitely more quickly than with no punishment. They show that as the intensity of punishment increased the time spent in the maze also increased. This general result was the same for both groups.

The effect of heavy punishment was to make the subjects cautious and hesitating—the same behavior that it produced in the chicks of Cole's study. In some instances the heavy punishment was

disruptive, disorganizing. This was shown by an increased frequency of entrances into blind alleys, but on the other hand the time spent in blind alleys was shorter when the punishment was severe than when it was light.

The experiments above cited upon mice, chicks, kittens, and man justify the following generalization: the speed with which a habit is formed is definitely related to the strength of the punishment used. If a task is easy or moderately difficult for a given subject, an increase in the intensity of punishment speeds up learning as shown by a decrease in the learning time and in the number of erroneous responses. But if the task is difficult, this principle does not hold. With a difficult task intense punishment makes the subjects cautious and negative, and it may even disrupt their behavior. For the learning of every activity, therefore, there is an optimum degree of punishment, but this optimum varies with the difficulty of the task, with the subject, as well as with the intensity of the pain incentive.

Degree of Punishment *versus* Hunger. In an experiment upon rats which employed the obstruction method Holden used three intensities of electric shock combined with various degrees of hunger. She found that only the weakest shock was suitable for her work. The two stronger shocks were severe enough to inhibit the hunger drive, paralyzing the normal food-seeking behavior.

Holden writes: "Shock 2, in general, had the effect of separating the animals of each starvation group into two classes: in one case the animals appeared to be motivated mainly by hunger and in the other mainly by fear. Shock 3 was so severe that it seemed to introduce an additional source of motivation which disturbed and obscured the normal hunger drive." It is a well-known fact that fear and hunger reactions are incompatible; when a hungry animal is confronted with a grave danger the gastric secretions and hunger contractions cease for a time.

The results of Holden's experiment are presented graphically in Fig. 58. Her curves show that the weakest intensity of shock gave the maximum number of crossings of the electric grill. They also reveal another interesting fact, namely, that the period of food deprivation which is required to give the maximal number of crossings for any constant intensity of shock varies with the degree of

shock used. This latter fact needs to be borne in mind in interpreting all results gained by the obstruction method. That method is based upon the establishing of a conflict between two basic motivations—in this case hunger and pain-avoidance (fear). Any experimental result obtained by the method varies with the strength of either of the two opposed motivating factors.

Effects of Punishment. Punishment in the form of painful stimulation, whether by the whip, a cuff on the ear, a spanking,

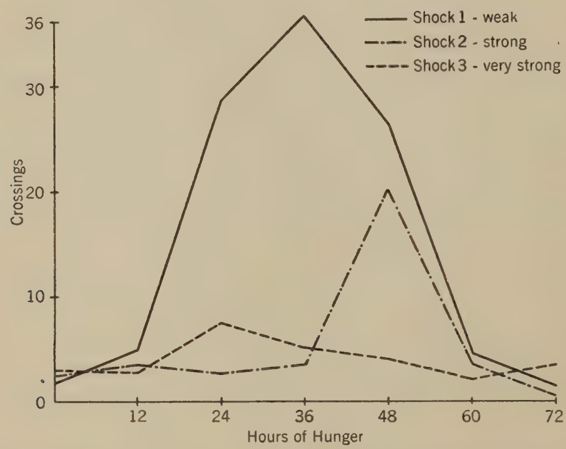

FIG. 58. MEDIAN NUMBER OF CROSSINGS OF ELECTRICAL GRILL WITH THREE DEGREES OF SHOCK, MADE BY GROUPS OF HUNGRY RATS. (*After Holden.*)

Ordinates indicate the number of crossings; abscissae the number of hours of food deprivation.

an electric shock, or any other means, has important psychological effects upon the individual. One of these is an *immediate motivation* apparent in the speeding up of behavior and in a rise of the general activity level. Just as inner stimulations release energy in the case of hunger, thirst, and other internal drives, so painful stimulations from the environment release energy when they excite the peripheral nerves. In a very true sense every stimulus which releases energy stored in the tissues motivates the organism.

Another effect of punishment is the immediate *negative reaction* aroused. Mild stimulations call forth only moderate avoiding reactions, but intense ones frequently arouse fear and *emotional dis-*

ruption. The modification of subsequent behavior, or *learning*, is still another effect of punishment. When an animal steps onto an electric grill and receives a shock he learns to avoid the place from which the shock came. Even after a single painful experience his behavior becomes hesitating, cautious, and sometimes fearful; with repeated experiences the animal may become permanently negative toward the grill.

This learning to avoid the source of painful stimulation is rapidly acquired in the natural world. Schaeffer, for example, has reported some observations upon frogs kept in a cage under "homelike" conditions and fed upon insects. In from two to seven trials these frogs had learned to avoid such "disagreeable" foods as hairy caterpillars, earthworms treated with calcium chloride or with oil of cloves, and a cockroach connected to an electric current so as to give a shock through the tongue and mouth when contact was made. Under laboratory conditions, however, where the problems to be solved are generally difficult and experimental conditions are unlike those in nature, the speed of learning is slow. In acquiring the ability to make a complex spatial discrimination, for instance, Yerkes found that the frog required as many as twenty to one hundred trials.

The foregoing analysis of the effects of punishment upon behavior is based entirely upon experimental studies in this field. One experiment in particular yields findings closely in agreement with our interpretations.

In this piece of work Rexroad administered punishment to his subjects through electrodes strapped to the palm and back of the left hand. The shock used was decidedly strong—intense enough to flex the middle and fore fingers. It usually elicited the words, "That's about as much as I can stand."

The task which the subjects had to learn was to discriminate among five colors and to select for each color the appropriate response key. One of five colored lights—red, green, orange, blue, white—was flashed upon a ground-glass screen in front of the observer. Each light, according to a prearranged code, corresponded to a particular key. When the correct key was pressed, another color immediately appeared and the reaction was automatically recorded on a counter. If the subject pressed an incorrect key, the color did

not change and the false reaction was automatically registered on another counter. Moreover, when mistakes were made the subject was given the strong electric shock as punishment. Incidentally, an additional incentive was furnished by telling the subject that his score would be equal to the total number of reactions minus the number of his errors.

At the start a punished and non-punished group were found to be about equal in score, but as the experiment continued the groups diverged. The punished individuals averaged 2.29 per cent more responses and 15.73 per cent greater accuracy than the unpunished. The differences, however, were not highly significant, and the variability within each group was large.

For present purposes the important point is Rexroad's interpretation of his findings. Punishment, he states, has three effects: *disruptive, incentive,* and *instructive.* If punishment is sufficiently severe, it becomes disruptive to behavior: performances requiring careful discrimination and coordination of movement deteriorate in speed and precision. When milder forms of punishment are employed, it is instructive and incentive, the performance improving in speed and accuracy. When *instructive*, punishment aids in defining an error effectively. As *incentive* it facilitates the avoiding of errors. The balance maintained among these three effects varies with the conditions of the experiment. The instructive effect of punishment is inversely proportional to the previous comprehension of the problem; consequently it is not present at all after a certain amount of practice. An incentive effect shows itself in a rapid seeking out of some scheme for learning a given task and in a greater care exercised to avoid errors throughout its performance. The disruptive effect is inversely proportional to the thoroughness with which the habit has been established; consequently, it offsets the incentive effect during the learning of a code, but is offset by the incentive effect after the code has been learned.

REWARD

In the child, innumerable rewards bestowed by parents and teachers serve at times to control behavior. A toy, a piece of candy, a gold star, a penny, the opportunity to play, permission to go to the circus, anything in fact which the child wants may function as a

reward. With adults, money prizes and other material rewards, medals, degrees, titles, honors, decorations, and numerous other social recognitions act as spurs to achievement. Any end or object which is deliberately sought may function as a reward when held out as a goal or when bestowed either by an individual or by the social group.

Many of the rewards which are effective with man are wholly ineffectual with animals. For the brute the obvious rewards are those which depend for their efficacy upon the physiological state of the organism. To a hungry animal, food is a reward, but the same food may be actively rejected if the animal is already satiated. Thus degree of hunger has a definite relation to the reward character of a given food. The experiments upon drive illustrate this point so abundantly and convincingly that no further evidence need be cited here. Although the biologically fundamental goals function as rewards with man just as truly as they do with animals, there are, as pointed out above, many other objectives which depend for their reward character upon man's high degree of socialization.

A number of experiments upon animals have been made in which various rewards were introduced, removed, delayed, and varied in other ways. Inasmuch as these experiments are very instructive from the standpoint of motivation several of them will be described here.

"Appropriateness" of Reward. To a hungry rat, food is an appropriate reward; to a thirsty animal, water. The appropriate reward is the one which satisfies a need and brings the corresponding drive to quiescence.

To study the importance of appropriateness in reward Elliott systematically varied the degree of hunger and thirst in male rats, offering them sometimes food and sometimes water as a reward. There were three groups of animals, the groups differing only in the relative degree of hunger and thirst aroused. The table on p. 292 describes the groups.

Every rat was given a daily trial on a fourteen-unit multiple-T maze. Running time and number of errors were scored. For the first nine days all groups were rewarded with bran mash; and for the last nine days all were rewarded with water.

The error curve for the different groups is plotted in Fig. 59. During the first nine days group *E* learned slightly faster than

Designation of Group	Number of Rats	Condition of Rats	
		Hungry	Thirsty
E.	28	Very	Very
F.	25	Very	Slightly
G.	22	Slightly	Very

either *F* or *G*, and the latter two groups were about the same. This indicates that the double drive of hunger plus thirst was more effective than either hunger or thirst alone, even though the reward was appropriate for only one of these drives. The differences between the successive error scores for group *E* and those for the other two groups are small and of low statistical significance, but the result of this part of the experiment agrees with much other evidence in showing that added motivation brings increased activity and speedier learning.

After the critical change on the ninth day the results for the three groups vary. With group *E* there was at first an increase in the number of errors when water was substituted for food, but the effect was only temporary, for at the close of the experiment group *E* was again slightly superior to the other groups. This disturbance can probably be attributed to the novelty of a changed situation.

The difference in behavior of *F* and *G* when the reward was changed is very instructive. Before the change these groups had been about the same. Bran mash, containing a certain amount of moisture, alleviated both hunger and thirst to some degree. After the change the thirsty animals markedly speeded up their learning when water, a highly appropriate reward, was offered instead of food. On the other hand, the hungry animals of group *F* slowed up their learning and showed relatively little gain when water, an inappropriate reward, was substituted for the former appropriate one.

Used in this connection the term "appropriateness" designates a relationship between physiological state and environmental conditions. There are many kinds of tissue needs; for each one a particu-

lar substance or energy change, or combination of the same, is required to restore homeostasis. That which is needed to this end is "appropriate."

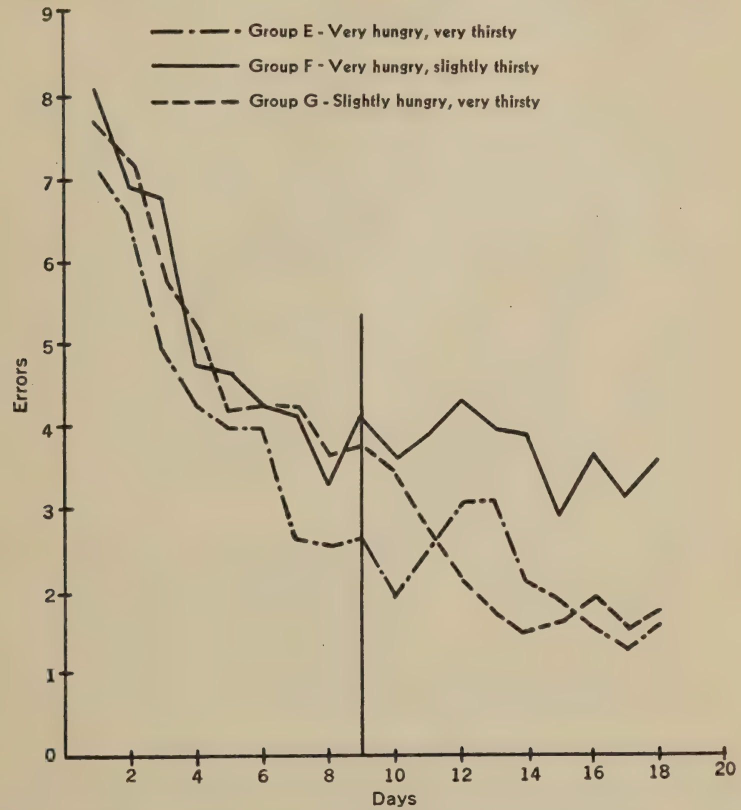

FIG. 59. SHIFT OF REWARD WITH VARIOUS DEGREES OF HUNGER AND THIRST IN COMBINATION. (*After Elliott.*)

Ordinates give average number of errors; abscissae days of experiment. All groups were rewarded with food for the first nine days and thereafter with water for an equal period of time.

In another experiment Elliott changed both the reward and the drive but in such a manner that the relationship between them was always an appropriate one. A control group of thirty-two rats learned the maze with thirst motivation and water reward. An experimental group of thirty-four rats learned the maze for the first nine days under the same conditions, but on the tenth and

following days they continued the maze under a different motivating state. Instead of thirst, hunger was evoked; instead of water, food was offered. That is to say, drive and reward were changed simultaneously in such a manner as to keep the relationship between them always an appropriate one.

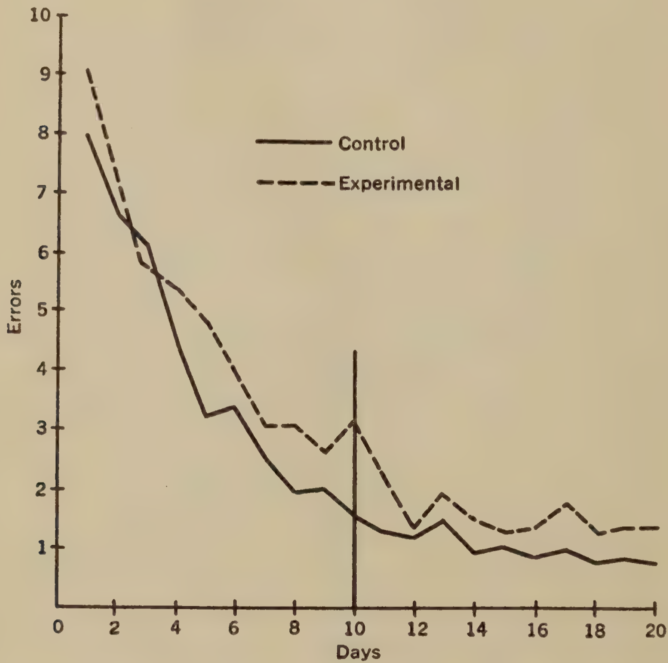

FIG. 60. CHANGE IN DRIVE WITH APPROPRIATE SHIFT OF REWARD. (*After Elliott.*) Ordinates give average number of errors; abscissae, days of experiment. On the tenth day, hunger with food reward was substituted for thirst with a reward of water for the experimental group.

The error curves for both groups (shown in Fig. 60) are normal learning curves in every way, despite the shift of drive and reward with the experimental group. The only apparent effect of this shift was a slight and temporary increase in errors and in running time when the change was made, but this can be referred to a disturbance of the accustomed conditions.

Elliott concludes that rewards may be changed without affecting the learning curve, provided the drive is also shifted so as to maintain an appropriate relationship between the two. This conclusion,

of course, must be qualified to take account of the strength of motivation. A shift from one set of motivating conditions to another makes little difference in an animal's behavior provided both motivations are equivalent as releasers of energy and provided further that the goal orientation be kept constant throughout the entire process.

Quantity of Reward. One way of studying different strengths of motivation is by varying the quantity of the reward offered. How does the speed of learning change with the amount of the reward? To get some light upon this matter, Grindley performed a number of experiments with chicks, one of which we will review.

Two groups of twenty-seven-day-old chicks were used as subjects; there were ten in each group. One group solved a maze problem with a single grain of boiled rice offered as a reward; the other with six grains in the reward box.

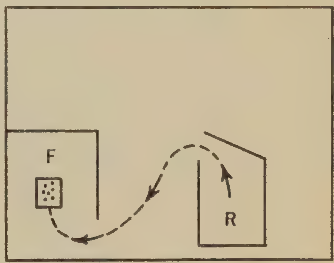

FIG. 61. APPARATUS USED TO STUDY THE EFFECT UPON LEARNING OF QUANTITATIVE VARIATIONS IN REWARD, WITH CHICKS. (*After Grindley.*)

The apparatus, which resembled a simple maze, is shown in Fig. 61. The chick was started from a retaining box, *R,* with the problem of finding a way to the food, *F.* The rice grains were on a tray which was concealed from the chick's view when at the place of release.

The score is based upon the reciprocal of the time taken by the chicks to reach the food after release. The learning curves, presented in Fig. 62, indicate that a reward of six grains of rice is somewhat more effective than a reward of one grain in motivating learning. The difference between total scores for the two groups is about 29 per cent. When the experiment was repeated with twenty other chicks the difference was 23 per cent.

These results are in line with our expectation on the basis of everyday human experience. A boy, for example, is more highly motivated when a whole box of candy is the prize than when a single bonbon is offered. A domestic servant or day laborer, as a rule, will work more energetically for large wages than for small. A teacher, doctor, or lawyer tends to react more vigorously to the

big salary or fee than to the small one. Of course, many factors other than the quantity of reward come into the picture of human motivation. In man, with his highly socialized drives, "unselfish" or "altruistic" behavior appears with little or no reward. Such behavior, on the surface of it, seems to contradict the principle stated

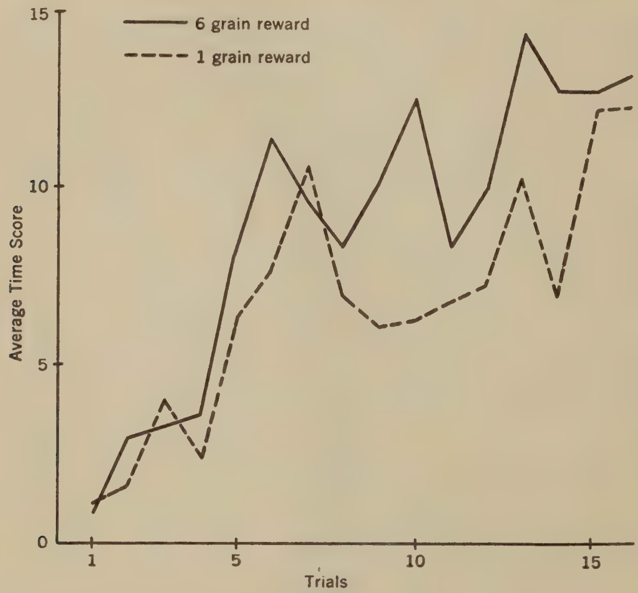

FIG. 62. VARIATION IN LEARNING CURVES WITH DIFFERENT AMOUNTS OF REWARD. (*After Grindley.*)

Ordinates give the average score for the group; abscissae, trials. Solid line, curve of learning when a reward of six grains of boiled rice was offered; dash line, the same with a reward of one grain of rice.

above unless one comprehends the whole picture as one of opposing motivational forces.

Kind or Quality of Reward. In human affairs the quality of reward is a factor of the most vital concern, and one which constantly affects the activity level. With animals, too, behavioral research reveals the relative effectiveness of different kinds of reward. The work of Ligon with hunger, social, and acoustic motivation, described on pp. 20-21, brings out the fact that quality of reward is a most important motivational factor. The experiment of Elliott with rewards of bran mash and sunflower seed, discussed on pp. 98-100, is

a further illustration of the same principle. The writer's food-preference studies demonstrate clearly the dependence of behavior upon kind of food (pp. 109-113). But perhaps the classical experiment upon the point is Simmons's study of maze learning under different motivating conditions.

Simmons's general method was to train equivalent groups of rats to run the maze, using a different motivation for each group. The incentives used were: reward of bread and milk; reward of sunflower seeds; escape from the maze; return to the home cage; receptive female for male rats; litter for mother rats. The ranking of the various rewards is based upon the number of trials necessary to learn the maze when each one was offered. Other criteria, such as the number of errors and total time, were also used by Simmons. Bread and milk was taken as a standard of comparison with the other incentives, their efficacy being expressed as ratios of the bread-and-milk scores of learning. The following figures give the rank order of the incentives:

Female in heat for male rats	0.55
Bread and milk plus return home	0.59
Litter for mother rats	0.74
Bread and milk	1.00
Sunflower seeds	2.04
Return home	6.93
Escape from maze	7.53

The above results, to be sure, are valid only for the particular degree of hunger employed in this experiment. None the less there is not the slightest doubt that the rate of learning varies with the *kind* of the motivating conditions.

Further, the variability of individual learning scores within a group also depends upon the kind of reward offered. That is, the less effective the motivation as shown by the learning curves, the more variable are the separate scores within the group and the less consistent the performance of a given individual from trial to trial.

Introduction of Reward (Latent Learning). If a man wanders aimlessly about the streets of a strange city, he learns to recognize certain landmarks. Although going nowhere in particular, he nevertheless becomes acquainted with the principal streets, buildings, and places of interest. Similarly if an animal is placed in

a maze which contains no reward, he explores in response to the novelty of the situation, eventually becoming habituated to the pathways. If, after such habituation, a reward is suddenly introduced at any given point in the maze, the animal quickly learns to go to the place where the reward is found. His previous exploration becomes of service to him in reaching the goal, and he arrives there more quickly than if he had not explored. The case is similar to that of the aforementioned man setting out to find a particular building after having become thoroughly acquainted with the gen-

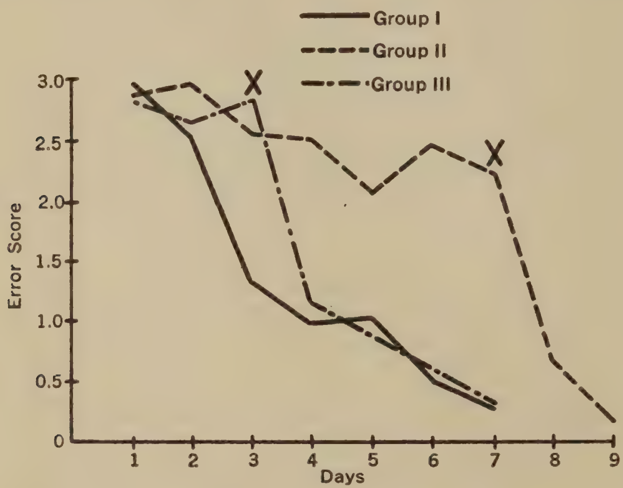

FIG. 63. CURVES SHOWING LATENT LEARNING. (*After Blodgett.*)
The solid line shows the normal learning curve with reward throughout. The two broken lines show curves of learning with the reward introduced on the days indicated by *X*.

eral locality. Exploration is of genuine service when a need arises.

In this connection, Blodgett experimented with groups of rats which he repeatedly placed in a maze containing no reward. When, after several days, a reward was suddenly introduced, the learning curves showed that the rats found the shortest pathway to the goal with remarkable celerity. This, Blodgett explains, was due to "latent" learning during the days of exploring with no reward.

The results of the study are shown graphically in Fig. 63. Group I (solid line) is composed of thirty-six rats which ran the maze once per day for seven days, at the end of each run being allowed to eat for three minutes in the goal-box. Group II (dash line) is

composed of an equal number of rats, litter mates, which explored the same maze for six days with no reward, but on the seventh and two following days received a reward. Apart from the reward they were treated in every respect like the animals of Group I. Group III (dot-dash line) is composed of twenty-five rats which commenced the experiment in the same manner as the other groups; a daily reward was introduced on the third day instead of the seventh. Groups II and III, therefore, differ only in the time at which the reward was introduced. The solid line shows the normal learning curve with reward throughout the experimental period. The two broken lines show curves of learning with the reward introduced on the days indicated by *X*.

Note that with Groups II and III the introduction of a reward is followed by an abrupt drop in the number of errors. The curves fall almost immediately to the level of the curve for Group I. This evident facilitation in learning is dependent upon previous exploration of the maze and habituation to it.

There is a slight and gradual drop in the curves of Groups II and III prior to the introduction of rewards—which indicates the presence of some motivation driving the animals to the goal-box quite apart from that furnished by the food reward. Escape from the maze always at the goal-box, or some other similarly weak motivation, was probably effective in producing this amount of learning. Had the technique been such that the rats were removed always from a different place in the maze, it is not conceivable that they would have learned to go to the empty goal-box.*

Removal of Reward and the Curve of "Unlearning." What happens when the reward is suddenly removed after complete learning? An answer to this question is found in an illuminating study by Sharp in which rats were given one trial per day on a maze until they had thoroughly learned it. Then conditions were changed. One group began running the maze without any reward; the other group continued to run with the accustomed food incentive. The results were striking.

With the rats from whom the incentive was withheld both the number of errors and the running-time increased; also greater variability from trial to trial appeared. The learning curve appar-

* In this connection see point number three made by Szymanski, p. 170.

ently reversed its direction and became what might be called a graph of "unlearning." The disintegration of the habit continued until a "breakdown" criterion was met. It was assumed arbitrarily that a habit had been broken down when 65 per cent of the animals gave a running-time equal to the average of the times for the first two trials during the original period of learning. The "unlearning" curve of errors is shown in Fig. 64.

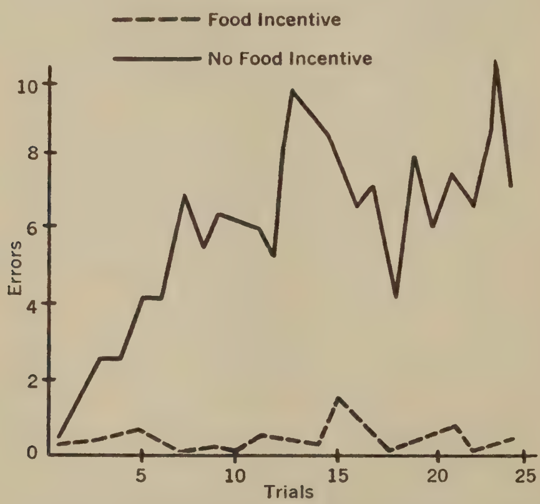

FIG. 64. EFFECT OF REMOVING REWARD AFTER LEARNING. (*After Sharp.*)

Removal of the reward when the maze had been completely learned made the curve of learning run backward (upper curve). A control group with continued reward showed no such effect (lower curve).

Sharp found, too, that the amount of disintegration after the reward had been removed varied with the number of trials given per day. When the number of unrewarded runs per working period was increased there was a very marked disintegration of the habit. The frequency of errors increased progressively from trial to trial, and the variability increased.

This response to removal of reward can be explained as follows. Learning of the maze was incidental to the food-seeking purpose. The process of learning established neural organization which regulated the hungry rats' behavior from start to the food goal. When the food goal was removed, however, the maze gradually lost its significance as a symbol of food-finding. In other words, the in-

tegrated behavior pattern from the start to goal achievement broke up. Relearning of the maze would doubtless have taken place much more quickly than did the original learning, if the food had been replaced and offered consistently as a reward.

A habit depends for its continuance not so much upon the acquired latent neural organization as it does upon the constant and persistent motivation which makes the individual move along a given learned course of action. The motive utilizes whatever neural organization is serviceable in the attaining of its goal. The best way to break a habit, therefore, is to change the motivation which determines it. Invariably an attack upon the basic motivation is the psychologically correct procedure, whenever the control of behavior is in question.

Symbolic Reward. A symbol is a sign or an object which stands for something else. A red traffic lamp symbolizes danger; the stars and stripes symbolize our country; a wooden hand with pointing finger symbolizes the direction of a path; a dinner bell symbolizes the forthcoming meal.

In an investigation upon albino rats Williams established a symbolic relationship in which white stood for food. She accomplished this by the ordinary process of conditioning. She trained three groups, of twenty-five animals each, to make a black-white discrimination. The white compartment was sometimes on the right and sometimes on the left side of the discrimination apparatus. When the rats went to the white side they received food; the white compartment thus became a symbol for food, a "conditioned stimulus." What is the efficacy of such a "conditioned stimulus" when employed as a reward? Will rats learn to run the maze when rewarded only by a *symbol* of food?

In seeking an answer to this question, Williams gave the animals one trial daily in the maze with different conditions of reward. Group III, used as a control group, was given food regularly in the goal-box; they learned the maze normally. The two other groups (Groups I and II) commenced the experiment with no reward, running the maze to an empty and unfamiliar goal-box. After thirty seconds in the goal-box they were removed to their cages. A moderate degree of learning was shown by these two non-reward groups, indicating that some incentive did exist. This probably consisted in

the removal of the animal from the maze always at the place of the goal-box.

On the ninth and following days the animals of Group I were treated differently. They were lifted immediately from the goal-box to the empty black-white discrimination apparatus. They had, of course, been previously conditioned to the white side of the box as a symbol of food, but this time they received nothing.

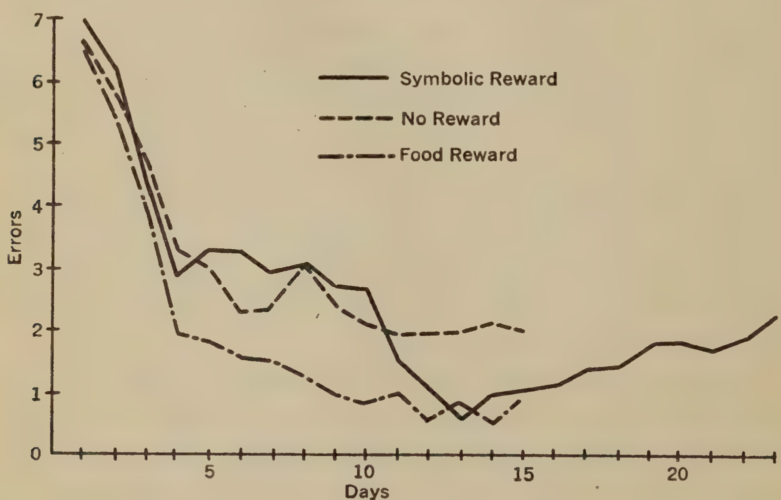

FIG. 65. REWARD VALUE OF A "CONDITIONED STIMULUS." (*After Williams.*)

The solid line shows the error curve for a group of rats which ran the maze until the ninth day with no reward except removal from the maze at the goal-box. On the ninth and following days the animals of this group were lifted into a discrimination box in which they had previously been trained to react to white as a signal for food. With symbolic reward the error curve dropped quickly despite the fact that no food was obtained. After day 13 this purely symbolic reward lost its effectiveness, as shown by the gradual rise in the error curve.

Figure 65 shows the abrupt drop that appeared in the error curve for Group I immediately after the introduction of the symbolic reward. Their errors fell to the level for the group receiving an actual reward (Group III). This learning effect, however, was only transient (pp. 303-304). With repeated trials the frequency of errors increased; the performance disintegrated until finally it again reached the level of Group II which throughout had received no reward.

The symbolic reward, therefore, was at first effective but it lost its efficacy with repetition. Along with the motivational decrement

the behavior of the animals distinctly indicated that they were ceasing to react to the white compartment as a symbol of food. The phenomenon suggests the extinction of a conditioned reflex as described by Pavlov.

Williams concludes that: (1) the "conditioned stimulus" has, for a time, a reward value equal to that of the unconditioned stimulus; (2) it soon loses this value if not reinforced by the unconditioned stimulus; (3) the loss of reward value is concomitant with the loss of its distinctive character as a "conditioned stimulus."

One other fact is of interest. Throughout the entire experiment all the groups received daily trials in the discrimination apparatus two or more hours after running the maze, and in these trials food was given regularly on the white side. The experimental group (Group I) continued to react to the white compartment as a symbol of food without any disturbance of the habit. In other words, Group I learned to differentiate between the symbolic significance of the discrimination box when presented by itself and that when the same box was presented as a part of the maze situation.

Inadequate Reward (Transient Learning). In one of Grindley's experiments chicks were placed at the end of a narrow runway (8 inches wide by 4 feet long) at the other end of which were grains of rice. With one group of chicks a piece of plate glass was placed a few inches in front of the food so that the chicks could see but not reach it. With another group the glass was not used, and the chicks could reach and eat the grains. Thus one group was motivated by the sight of a reward and the other by actual attainment of it.

The chicks of both groups were tested in pairs, and the time was measured between the release of a pair and the instant when the slower of the two chicks reached a fixed point a few inches in front of the food. The speed scores are based upon this time measurement. Each pair of chicks was given twelve trials in rapid succession. The result for the two groups is as one might predict. The chicks motivated by an actual reward showed consistently rapid gains in speed. The other group, which was motivated only by the sight of rice grains, and received no genuine reward, exhibited quite different behavior. For the first four or five runs they showed an increase in speed followed by a gradual decline. See Fig. 66.

Grindley believes that the sight of a food reward induces learning, even when the consummatory response of eating it is impossible. But this inadequate reward loses its motivating effectiveness when repeated trials fail to bring the animal to the visible goal. This loss of effectiveness in a given motivation recalls Ligon's findings with the use of a continuously sounding electric buzzer as an incentive. The acoustic stimulation at first motivated maze learning in rats, but upon repetition it became somewhat less effective (pp. 21-23).

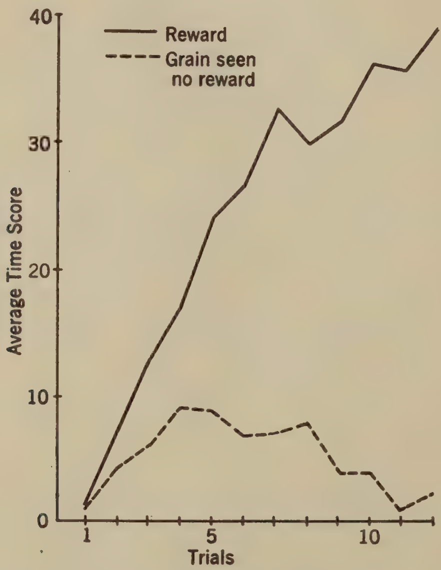

Fig. 66. Curves Showing Transient Learning. (*After Grindley.*)

Ordinates give the average speed score; abscissae, successive trials. Upper curve, actual food reward; lower curve, grain seen but the chicks were not allowed to eat it.

Grindley's conception of transient learning and Blodgett's conception of latent learning are in some respects related. By "transient" learning Grindley refers to temporary learning which gradually disappears after the goal is found to be unattainable. By "latent" learning Blodgett means learning which has actually taken place but which manifests itself in activity only when adequate motivation is furnished to call forth the learned reactions. It is interesting that the two experiments were published independently during the same year, since both show the fundamental importance of continuous motivation if learning is to go on to completion.

Delay of Reward. What happens when the reward is delayed instead of appearing immediately after the discrimination or the behavior pattern to be learned?

Hamilton studied the effect of delayed reward, using both the obstruction and the learning methods. With the obstruction method, rats were held in a delay compartment for varying intervals of

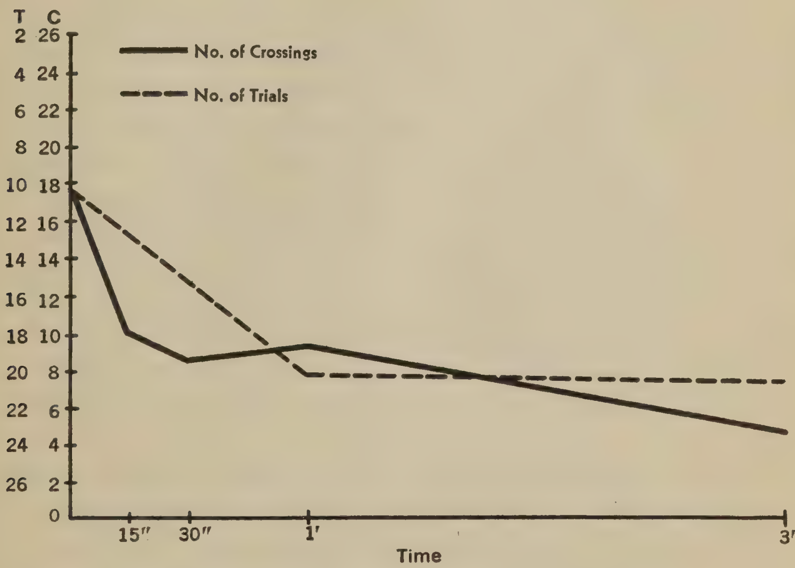

Fig. 67. Effect of Delayed Reward. (*After Hamilton.*)

Ordinates give number of trials (T) needed to learn the maze and also number of crossings (C) of the electrical obstruction per test period. Abscissae, time of enforced delay. Solid line, average number of crossings in obstruction apparatus with the graduated delays of reward. Dash line, number of trials required to learn the maze with the delay periods indicated.

time—0 second (*i.e.,* no delay), 15 seconds, 30 seconds, 1 minute, 3 minutes—after they had crossed the electric grill and before access to the food was permitted. With the learning method, rats ran the maze toward the goal, but were detained in a delay box, for the same series of time intervals, before access to food was given them. With both methods, delaying the reward reduced the effectiveness of the motivation, as the graphs in Fig. 67 demonstrate. These curves show that the reward that was immediately given was far more effective than any that were delayed.

The above result is somewhat different from an earlier one reported by John B. Watson. Using a problem box in which the rat had to dig through sawdust to reach the food, Watson ran two groups of rats under different conditions. One group was fed immediately upon reaching the goal-box; the other was forced to delay for thirty seconds. Watson reports that the delay of thirty seconds after solving the problem did not retard the learning process. He states, however, that during the enforced waiting the animals were working vigorously to reach the food; they were constantly active and frantic to get to it. On the basis of this statement it is fair to assume that during the period of delay the rats were constantly in sight or smell of the food, that they were persistently oriented toward the goal and vigorously active to reach it. The enforced waiting presumably did not disturb this goal orientation. It appears to have been, from the rats' point of view, an integral portion of the time consumed in a continuous drive to the goal. In Hamilton's experiment the delay was more artificial and disorienting to the animals. These two experiments are not contradictory, because the conditions of enforced waiting were so completely different.

A recent and carefully planned study of delayed reward has been made by Wolfe at the University of Illinois. Working with rats and employing a discrimination technique, he found that as a reward is delayed its effectiveness as a learning-producing agency decreases with extreme rapidity. According to Wolfe, the greater part of this effectiveness is lost with a delay of less than one minute, and not until the delay has reached twenty minutes does the effectiveness of reward become approximately zero.

REWARD *VERSUS* PUNISHMENT

Is reward more effective than punishment as a means of training the animal and the child? The question is a moot one because many who discuss it have failed to make an adequate analysis of the problem. To aid in removing the difficulties some of the experimental evidence which bears upon the question will be considered.

Pain Avoidance and Hunger. In an experiment to determine the relative effectiveness of reward and punishment as incentives

for learning, Hoge and Stocking made use of the visual brightness discrimination problem with Yerkes's technique (pp. 281-282). White rats were trained to make a choice which was contrary to their innate preference for light or dark. Two animals were punished with electric shock for wrong choices; two others were rewarded with milk-soaked bread for right choices. With a third pair of rats both punishment and reward were used.

The combination of punishment and reward was found to be more effective than either incentive by itself for the learning of a visual discrimination in the rat. Of the two incentives when used separately, punishment proved more effective than reward in speeding up the time of learning.

The above conclusion—that a combination of reward and punishment is more effective than either alone—falls directly in line with the findings of many other experimenters who have studied combined motivating factors. Because of this agreement it can be accepted despite the small number of subjects. But the generalization that punishment is more effective than reward obviously needs some qualification; the relative strength of these two factors has to be taken into account. Realizing the difficulty, Dodson wrote: "The experiment on the relative value of punishment and reward as motives shows almost nothing of the relative value of these two motives. The strength of the electric shock used may have been the most unfavorable to the learning process while the degree of hunger was the most favorable, or the strength of shock may have been the most favorable while the degree of hunger was the most unfavorable."

To avoid this difficulty, Dodson repeated the Hoge-Stocking experiment, working with various strengths of electric shock and several degrees of hunger. He employed in his study four strengths of shock (measured in Martin units) and four degrees of hunger (measured in hours of food deprivation). A separate group of ten rats learned to make a visual brightness discrimination with each of the intensities of shock and each of the degrees of hunger. The different incentives were used alone, not in combinations. Thus there were eight groups of ten rats each, eighty subjects in all. In the punishment series the rat was given a shock if he entered the darker compartment, whereas the lighter one offered him an escape

from the apparatus. In the reward series the subject was served toasted corn flakes soaked in cream just outside the lighter compartment; no escape was permitted through the darker chamber.

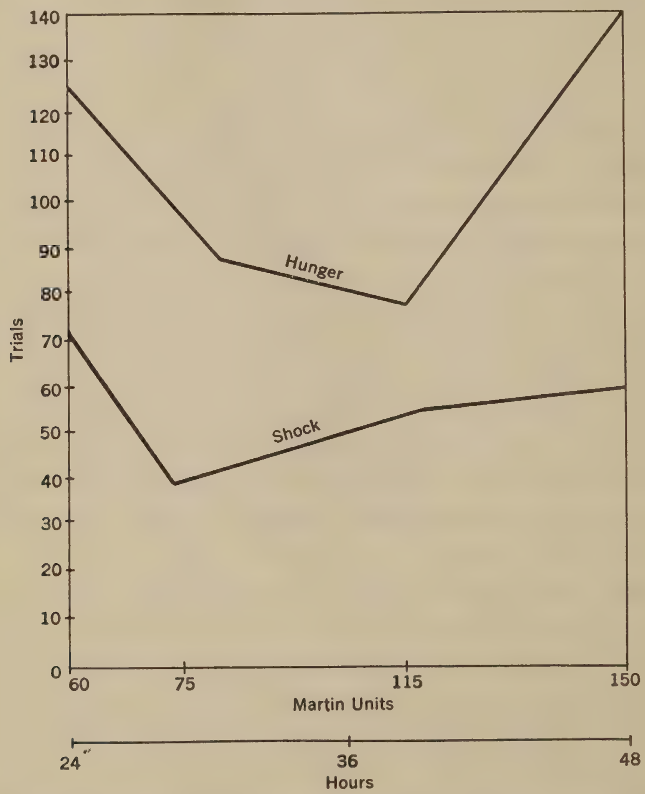

FIG. 68. RELATIVE VALUES OF HUNGER AND ELECTRIC SHOCK AS INCENTIVES TO LEARNING. (*After Dodson.*)

Ordinates give number of trials needed to meet the criterion of learning. Abscissae are: (1) Martin units to measure strength of shock; (2) hours of food deprivation to measure strength of hunger. Upper curve, hunger motivation; lower, pain avoidance.

The graphical representations in Fig. 68 contrast the effects of the two forms of motivation—hunger and painful electric shock. The hunger curve (upper) shows the speed of learning with food deprivations of 24, 31, 41, and 48 hours. There is an increase in the speed of habit formation as food deprivation increases, up to 41 hours, but a sudden decrease between 41 and 48 hours. With deprivation periods above 48 hours the rats appeared not to be hungry; they

neither rushed to get food nor did they eat it when they encountered it. They assumed a hump-like posture similar to that of sick or starving animals. This behavior is explained by the fact, stated earlier, that extreme hunger weakens the animal and markedly lowers its activity level (pp. 117-119).

The shock curve (lower) gives an optimum at 75 Martin units despite the fact that a current of 150 units is far below the point of injury to the subject. Animals trained with 75 units approached the grill very cautiously, whereas those trained with stronger shocks rushed headlong into one of the boxes, seemingly trying to escape from the situation by running rapidly over the grill. Judging from the rats' behavior, it is clear that the greater length of time required to perfect the discrimination habit with shocks stronger than the optimum was due to an emotional disturbance produced by the very painful shocks.

Figure 68 demonstrates strikingly the existence of optimal intensities for both types of motivation. Further experiments are now needed to determine the exact location of these optima and the various conditions affecting them. One other point is apparent from the graphs. All degrees of shock brought quicker learning than any degree of hunger. Hence, under the conditions of the experiment it would be correct to say that pain avoidance was relatively more effective than hunger motivation in producing learned behavior. This confirms the above-mentioned result of Hoge and Stocking that punishment motivates the animal more effectively than reward, but it goes a step further in comparing quantitative differences in these motivations.

Despite the careful control of intensity in Dodson's experiment the whole problem appears to be misconceived. "Punishment" and "reward" are interpretations, practically important but not psychologically fundamental. In the above experiments it is clear that two basic types of motivation were contrasted: (1) peripheral pain avoidance, and (2) hunger. Both types of motivation have essentially the same general pattern: persistent painful stimulation, either from the grill or the contracting stomach, with resultant behavior which sooner or later removes the source of such stimulation. What Dodson has really done is to contrast motivations resting upon two

types of painful stimulation, rather than reward and punishment as such. He found that peripheral pain stimulation, which ordinarily threatens damage to the tissues, was more potent than hunger.

Punishment and Reward in a Social Setting. The conceptions of "reward" and "punishment" are interpretations based upon positive and negative behavior, or upon pleasant and unpleasant feelings. Only those incentives which induce unpleasant feeling are potential punishments, and only those which are satisfying can serve as rewards; but in the human realm the subject must interpret these presentations as punishments and rewards for them to function as such. This truth becomes clearer as soon as the problem is carried over into the field of socialized behavior. The gold star placed after the name of a pupil, the silver cup given to the winning team, the fool's cap grudgingly accepted by the dullard, the expressed approval or disapproval of one's superiors—these symbols and situations constitute genuine rewards and punishments. As such they derive their efficacy from an effect upon self-esteem rather than from an effect upon the tissues.

The author's view of reward and punishment agrees with that stated by Hamilton: "Whether an incentive stimulus is in the nature of a punishment or of a reward depends not upon the physical stimulus itself, but upon the conditions under which it is given, and so might be said to be an interpretation on the part of the subject, a subjective thing. It is readily conceivable that under certain conditions an electric shock might be considered as a reward, and that food might become punishment."

In a well-devised experiment Hamilton planned conditions such that the sound of a bell would serve to one group as reward and to another as punishment. This plan assured that both kinds of incentive would have the same basis in sensation. The experimental task required an estimation of visual extent. The subject was seated before a modified Galton bar, the usual form of which is pictured in Fig. 69. To the left of the central hair line was measured off on the bar a standard length of 120 mm.; on the right a variable extent of the bar was visible. At the start of each trial the movable shield was placed at the center line and the subject was instructed to move it outward until the length on the right was twice that of the stand-

ard length on the left. When satisfied with his adjustment the subject pressed a button to give a signal to the experimenter that the task had been completed.

There were sixty subjects. On the first day each individual made fifty adjustments of the shield. From measurements based upon these results the average error was computed for each person. On the second experimental day the first five trials were made under the same conditions as before; then the subjects were divided into six groups of ten each and given different kinds of treatment as follows:

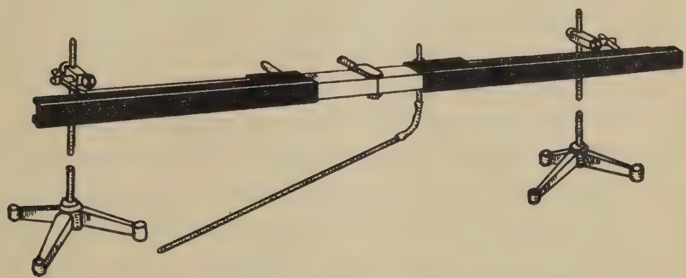

FIG. 69. GALTON BAR FOR STUDYING THE ACCURACY OF ESTIMATION OF VISUAL EXTENTS. (*A modified form of this apparatus was used by Hamilton.*)

The subject, seated in front of the apparatus, grasps the adjusting rod, and by rotating it causes the black shield on the right to move until the extent of the visible bar on the right of the hair line appears *equal* to that on the left, or *twice* that on the left.

1. A *control* group completed the second day with no special motivation. In other words, the method used with this group on the first and second days was identical.

2. The members of a *punishment* group were told that a bell would ring when they pressed the button at the end of each trial, if the length they estimated was *wrong*.

3. Conversely, the members of a *reward* group were told that a bell would ring when they pressed the button, if they had adjusted the length *correctly*.

4. A *guess-with-punishment* group was treated the same as the punishment group except that in every case the individual subject was required to guess the direction of his error. He was not told whether this guess was right or wrong.

5. In a *told-with-punishment* group the individuals were treated

exactly as in the punishment group, except that every subject was told the direction of his error.

6. A *knowledge* group heard the experimenter announce in a matter-of-fact voice "long," "short," "right." No bell was used.

The average errors computed on the first day gave a basis for determining whether an adjustment was "right" or "wrong." Hamilton regulated the apparatus in such a way that the bell would ring for members of the reward group whenever the error of an adjustment was less than the average error for the individual concerned. For members of the punishment group the bell rang whenever an error was greater than an individual's average error. This arrangement assured an equal number of "right" and "wrong" adjustments in the long run for every subject. Furthermore, on the second day a new average error was computed after every five trials; as each subject's error decreased with practice the apparatus was constantly adjusted to correspond to the lowered average error. This plan gave approximately equal numbers of rewards and punishments, with no possibility of changing the ratio by practice.

How much did the average errors decrease under the different incentive conditions? To answer this question the measure of the average error for a group on the first day was taken as a base (100 per cent), and the average error for the last five trials was expressed as a percentage of this base. The values computed in this way follow:

Group	Percentage of Initial Error	Group	Percentage of Initial Error
Control	127	Guess-with-punishment	15
Punishment	24	Told-with-punishment	20
Reward	26	Knowledge	45

Results with the *control* group indicate that continued estimations of visual extent in the absence of any information about the correctness of one's work, and in the absence, too, of all special in-

centives in the form of rewards or punishments, will show no improvement. Indeed, the finding of 127 per cent of error suggests definitely that the subjects of the *control* group became increasingly indifferent and careless in carrying out their work. The remaining five groups all exhibited marked reduction in their average errors. The reduction was present in each individual case as well as with the group as a whole.

The results for *punishment* and *reward* groups are not reliably different. In regard to this Hamilton reminds us that the physical aspects of punishment and reward were identical—the very same bell served for both, nor did the method of presentation vary. The only difference between punishment and reward, therefore, was in the mental attitude of the subjects toward the bell. This difference, however, was a very genuine one. In the case of punishment, the subjects sometimes swore at the bell, made faces when it rang; and all adopted the attitude of trying to keep it from ringing. In the case of reward, the spontaneous behavior of the subjects when the bell rang was quite the opposite. They gave exclamations of delight upon hearing the bell, sighed, and said "What a relief," "That's better," etc.; and all appeared to be trying to make the bell ring as frequently as possible.

It is difficult to know to what extent pleasant and unpleasant feelings were aroused by this type of punishment and reward. Such affective processes were undoubtedly more common with the *punishment* and *reward* groups than with the *knowledge* group. This group received the most information of all, but it was given in a non-emotional, matter-of-fact way. Knowledge of results alone reduced the average error to 45 per cent of its measure at the beginning of the experiment. Contrastingly, punishment and reward combined with less information effected much greater reductions in error.

Turning now to the *guess-with-punishment* group we are impressed by the fact that it made the greatest reduction in average error of all the groups (though not a reliably greater reduction than that of the *told-with-punishment* group). The *guess-with-punishment* group were more active than the others and although they were not informed as to the accuracy of their guessing, their additional activity gave them an advantage over the *told-with-*

punishment group which merely received information passively. These results are in line with the well-known principle that we learn by reacting. It would be interesting to know just how far the activity of guessing helped to make the *guess-with-punishment* group the most successful of them all. It seems likely that both the *guess-with-punishment* and *told-with-punishment* groups were more constantly aware of the correctness or incorrectness of their reactions than the groups with either punishment or reward alone, and that this enforced emphasis upon results favored greater accuracy.

On reviewing the conditions of the study the interesting suggestion occurs to one, that there may be a variety of facilitating factors in the experimental situation: an *information* factor, present in the highest degree with the *knowledge* group; an *incentive* factor, present in all the *reward* and *punishment* groups and perhaps to a much smaller extent in the *knowledge* group; an *emotion* factor, present in both the *punishment* and *reward* groups. There is also an *activity* factor, present to the highest degree in the *guess-with-punishment* group. It would be worth while to repeat this experiment varying only the physical characteristics of the reward-punishment. One might, for example, use the voice, an electric shock, a perfume, a fire gong, etc., as incentives.

Among the more general conclusions of the study Hamilton makes the arresting statement that the special incentives yielded greater accuracy of visual length discrimination than had heretofore been attained in this well-known laboratory experiment.

Concluding Statement. The difference between a "reward" and a "punishment" lies in the attitude of the subject. A reward is something desired and positively valued when received. A punishment, on the other hand, is disliked and negatively valued. A reward is bestowed, a punishment is inflicted, by someone or something within the external environment. Although either of these two opposed attitudes can be built up towards one and the same bit of experience, ordinarily stimulations and situations which normally induce negative reactions serve as punishments, and goal objects are utilized as rewards.

The practical side of the problem of punishment and reward relates to the control of behavior, especially to the training of children. Discipline through punishment often takes the form of in-

flicting pain; it sometimes takes the form of producing unpleasantness through reproof, or through denying some privilege or some desired object. Discipline through rewards also has many forms. The reward may be a gift of money, candy, or some pleasure-bringing object, or the permission to do some enjoyable act such as to go on a picnic; or the reward may be merely the withholding of punishment; further, a reward may be the giving of social approval.

Punishment-reward techniques have been utilized for countless ages, in the control of human behavior, especially to impress upon the youth those behavior patterns which are prescribed by custom and taboo. Early laws with their drastic codes presuppose that behavior can be controlled through punishments and to a less extent through rewards and social recognitions. Regardless of one's views on training through punishment, the psychological fact remains that this form of incentive is very effective in bringing modifications of behavior. It is not an exaggeration to say that in some form or other motivation through rewards and punishments touches every phase of human life.

Finally, the materials presented in this chapter give rise to two fundamental problems for the psychologist. The first is concerned with the conditions which induce positive and negative behavior. The simple reactions of seeking and avoiding, as well as the more complex and persistent appetites and aversions, raise basic questions concerning the conditions which evoke movement either *toward* or *away from* an object. The second fundamental problem relates to the acquiring of the neural organization which predisposes an organism to react positively or negatively. In the next chapter we shall see that positive and negative reactions play a leading rôle in the process of learning—a rôle practically recognized in the application of rewards and punishments.

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CHAPTER VII

PSYCHOLOGICAL HEDONISM

"Even the most trivial likes and dislikes, such as preferring roses to lilies, or blue to green, have their motivation."

—Aaron J. Rosanoff

People commonly say that they carry on certain activities "for their own sake." Playing baseball, fishing, painting, beating time to music, and countless other recreational and self-expressive activities go along seemingly of their own accord. In daily life we frequently explain such actions by referring to pleasant and unpleasant feelings. "I do what pleases me, and I do it *because* it pleases me." "I go to a concert or to a movie solely to seek pleasure." "I avoid all unpleasant things, and I avoid them *because* they are unpleasant." Thus pleasant and unpleasant feelings are tacitly assumed to regulate and motivate action. Moreover, it is ordinarily taken for granted that choices are determined in some way by pleasant and unpleasant feeling ("pleasure and pain") so as to favor the former and oppose the latter.

From the historical standpoint the doctrine of hedonism has played a considerable rôle in human thought. The hedonistic doctrine in one form or another is found in the writings of Aristippus and Epicurus; it is developed in the writings of Hobbes, Locke, Hume, Bentham, John Stuart Mill, and Spencer. Philosophers have distinguished between the ethical and psychological forms of this doctrine. The ethical form of hedonism affirms that happiness is the goal of all action, the *summum bonum* of life, and that men should direct their lives so as to attain pleasure or happiness and avoid the opposites. Any philosophy of life, however, which affirms that men *ought* to do so and so, and which upholds standards for judging human conduct as right or wrong, is outside the scope of scientific psychology. For the psychologist the good man preaching a sermon in the pulpit and the bad man wallowing in the mire are equally

important as subjects for scientific study. The scientific frame of mind is factual and observant rather than evaluative and appreciative.

Psychological hedonism is a wholly different matter. This is a doctrine of motivation which postulates that men do, in fact, act so as to attain pleasure and to avoid pain. Thus Bentham wrote: "Nothing can act of itself as a motive but the ideas of pleasure or pain." And again: "A motive is substantially nothing more than pleasure or pain, operating in a certain manner."

Several modern psychologists have held to the hedonistic doctrine. Freud's formulation of the pleasure principle (which he later abandoned) is a case in point. The child, according to this principle, starts life with a craving for pleasure. Playing, eating, sleeping, sucking the thumb, and many other activities are carried on for the sake of the pleasure they yield. If the child has received pleasure in the past from some activity, he will seek to reproduce it so as to regain the same pleasure. If, for example, his mother has rocked him to sleep with an effect which was enjoyable to him, he will seek regularly to be rocked when going to sleep. Gradually, according to Freud, the environment curbs the child; he is forced to face the real world and he no longer acts merely for pleasure alone.

In a recent book upon the fundamentals of human motivation Troland devoted several chapters to psychological hedonism, working out a rather elaborate hedonistic theory. He distinguished three kinds of hypotheses: (1) *Hedonism of the present* assumes that pleasantness and unpleasantness of the present moment immediately regulate one's actions in such a way that the pleasantness is maintained and the unpleasantness is brought to an end. (2) *Hedonism of the past* expresses the view that pleasant and unpleasant experiences in the past have modified neural organization; through such modifications the feelings regulate present behavior. (3) *Hedonism of the future* postulates that the anticipation of future pleasantness and unpleasantness motivates action. Troland committed himself to a hedonism of the past, developing the theory at length.

A lucid but less analytical hedonistic doctrine has been formulated in a brief study by Bühler. He states that certain forms of free activity are of themselves pleasurable. The unrestrained play of

children brings what he calls "function pleasure." Bühler writes: "If a first sign, *D,* means displeasure and a second one, *P,* pleasure, then psychologists have generally agreed, since Aristotle and Epicurus, that the general direction of human activity is, as a rule, from *D* to *P*. In terms of behaviorism we may say: There is a steering principle to be found in the field of movements we can observe. . . ." This steering principle is unmistakably an hedonistic one.

In the present chapter our immediate aim is to assemble the facts of experimental psychology which have a direct bearing upon the doctrine of psychological hedonism. In a concluding section we will evaluate the hedonistic doctrine in the light of the psychological facts. First we will consider the work upon interests, for interesting activities are commonly said to be motivated by the pleasantness which they yield.

INTERESTS

Interests are activities which one carries on repeatedly and consistently for their own sake. Apart from the appetites, which clearly are determined by organic states (pp. 271-278), human beings manifest a wide variety of interests. There are interests in golfing, stamp collecting, professional football, amateur dramatics, singing, gardening, social service, writing poetry, contract bridge, interior decorating, cabinet making, and so forth. Ask a man why he carries on any one of these activities; he will reply, "Because it is pleasing to me," or "Because I like it," and that is the end of the matter so far as he is concerned. Thus the hedonistic principle, as noted above, is constantly appealed to for explanation of one's activities.

Certain it is that odors, tastes, warm and cold touches, and other sensory impressions induce fairly uniform reactions of liking and disliking quite apart from training. The child also derives pleasure from manipulating toys, from tones, colors, forms, moving objects, and from mechanical effects. Later he finds it pleasing to run about, to climb trees, to explore, to control the behavior of animals and persons, to raise plants, to build and fly kites. The world is interesting, as Woodworth expressed it, not merely because it affords us food and shelter, but because we contain within ourselves adaptations to many of its objective characteristics. In dealing with these

characteristics we are aroused to interesting and satisfying activities, even apart from the basic biological drives.

In psychological studies it has been commonly assumed that an interest is a pleasing activity associated with persistent positive or maintaining behavior. Thus Strong writes: "An interest is accompanied by pleasant feeling and by a dynamic tendency to seek the object or do something with it. Aversion seems to be the best antonym to interest. An aversion is accompanied by unpleasant feeling and a tendency to escape from the object. The verbs 'like' and 'dislike' express such meanings and have been used in securing our data, not 'interest' and 'aversion.' Interest in the movies means that one enjoys attending them and does so. Aversion to calculus means that if possible one avoids the need to solve problems involving calculus. It is only natural, then, that a measurement of one's interests is also a measurement of what one will do, other things being equal. As one does not long continue to like what one cannot do, it is only to be expected that a measurement of one's interests is approximately a measurement of what one can do. . . ."

In an excellent summary of all that has been done to date in the measurement of human interests, Fryer separates the conception of interest from that of motivation. Motivation, he states, is the *energy* aspect of experience and reaction; a basic motivational principle is that varying degrees of stimulation liberate different quantities of energy. Interest, on the other hand, refers to qualitative change in behavior; it is the *acceptance-rejection* aspect of reaction. Measurement of motivation and measurement of interest are thus separate, according to Fryer, and it is important to keep them apart to avoid experimental confusion.

The distinction between the energy aspect and the acceptance-rejection aspect of activity is without doubt an important one. In this book, however, we have not limited the field of motivational psychology to a study of the energetics of activity. Rather, we have defined the problem of motivation so broadly that it includes the investigation of every aspect of acceptance and rejection, the total process of regulation and control of behavior, and not energetics alone. According to the author's view, the analysis of interest belongs within motivational psychology rather than outside and apart

from it. But, regardless of definition, the facts summarized by Fryer are of great scientific and practical importance.

The Measurement of Interests. In the various tests for diagnosing human interest a common method is to have the subject indicate whether he likes or dislikes some activity, such as writing poetry, speaking in public, hiking for recreation, solving equations in physics or chemistry, doing carpentry work, entertaining guests, setting up machinery, reading newspapers. Generally such tests also include a list of names of objects and persons to be scored in terms of liking or disliking, as: mice, parents, Marconi, Pasteur.

Strong's vocational interest test presents this instruction to the subjects: "Indicate after each occupation listed below whether you would like that kind of work or not. Disregard considerations of salary, social standing, future advancement, etc. Consider only whether you would like to do what is involved in the occupation. . . . Work rapidly. Your first impressions are desired here. Answer all the items. Many of the seemingly trivial and irrelevant items are very useful in diagnosing your real attitude."

In his interest-testing blank Strong has arranged 420 items* to each of which the subject is required to react in terms of liking, indifference or disliking. The test contains: one hundred different occupations, *e.g.*, actor, college professor, dentist, poet, surgeon; fifty-four amusements, *e.g.*, golf, poker, billiards, *American Magazine;* thirty-nine school subjects, *e.g.*, algebra, Bible study, public speaking, zoology; eighty-two activity items, *e.g.*, repairing a clock, handling horses, calling friends by nicknames, saving money; sixty-three peculiarities of people, *e.g.*, progressive people, emotional people, cripples, bolshevists; forty-two miscellaneous items; forty estimates of present abilities and characteristics, *e.g.*, "usually start activities of my group," "am quite sure of myself," "discuss my ideals with others." (The self-estimates are scored in terms of "yes," "?" and "no." The subjects are instructed to: "Indicate below what kind of a person you are right now and what you have done, etc.")

The test was given to 2340 men between the ages of twenty and sixty, distributed among eight occupations: engineers, lawyers, in-

* The number of items varied with the test revision.

surance men, ministers, physicians, school men, writers, and Y.M.C.A. secretaries. Differences among these occupational groups were found to be greater than differences dependent upon age (Fig. 70). A characteristic set of interests was revealed for each occupational group, and these interests did not wax or wane very much with age. Because of this the interest analysis technique is of practical importance in the diagnosis of occupational bent and in vocational guidance.

Interest and Capacity. Every parent recognizes that individual differences in interests are revealed in the behavior of children at a very early age.

> Johnny wants a pair of skates, Susy wants a dolly;
> Nellie wants a story book, she thinks dolls are folly.

How do these early acceptances and rejections arise?

It is evident that there are two factors which play a dominant rôle in directing the channels of interest: innate capacity, on the one hand; skills acquired through learning, on the other. Consider, for example, a girl with a sensitive musical ear which enables her to discriminate pitches accurately, and to recognize nuances of loudness and timbre. She can learn melodies readily and sing them on the key; she has a keen sense of rhythm as shown by her playing and her dancing; she can learn to read music easily and accurately. All these capacities, whether native or acquired, make musical performance as easy and natural to her as rolling down a hill. She readily excels other children in musical performance and for this wins the praise of her parents and teachers. This praise, in turn, acts as a spur to still further achievement. Undoubtedly her native capacity has much to do with the pleasantness which she derives from such unrestrained activity. Yet it must be admitted that her thorough musical education greatly enhances the pleasantness gained from her chosen art. Every interest, whether an art, a sport, a hobby, or something else, is dependent upon the same two important factors for its existence.

The Shifting of Interests. Observations made by Lehman and Witty upon American boys and girls indicate that there are many shifts of vocational interest at the time of adolescence. For example, the desire to be a movie actor or actress usually declines

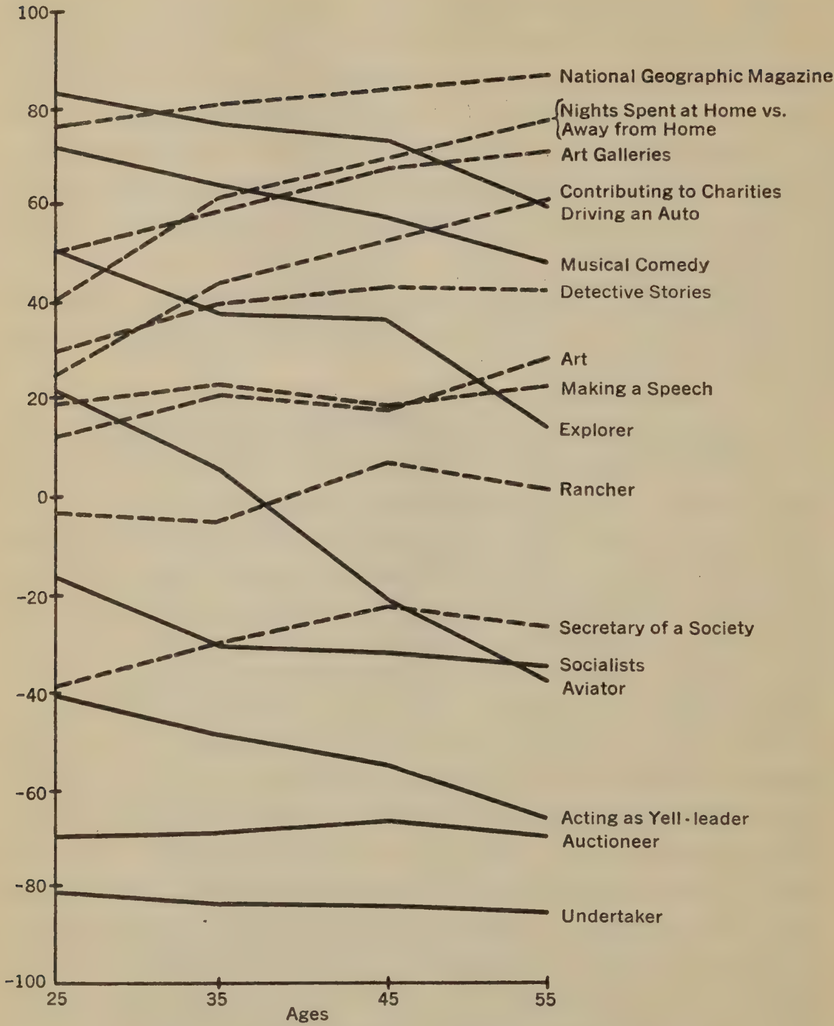

FIG. 70. CHANGE OF INTERESTS WITH AGE. (*After Strong.*)

The curves are based upon a study of the interests of 2,340 men. The attitude index on the vertical at the left presents numerical differences between the percentage of a group liking and the percentage disliking the various items in question. Indifference, when expressed, is ignored in computing the attitude index. For example, at age twenty-five, 88 per cent like and 2 per cent dislike driving an auto; the attitude index in this case is 86 per cent. At age twenty-five, 3 per cent like and 84 per cent dislike the occupation of undertaker; the attitude index is —81 per cent. The solid lines represent interests which decrease with age or remain about constant; the dotted lines, those which increase.

with the onset of pubescence; interest in becoming a cowboy generally wanes at the same period. The vocational counselor should keep in mind this rapid shifting of interests during adolescence.

By contrast the interests of adults are relatively stable, but even here the changes of interests are more rapid between the ages of twenty-five and thirty-five than in succeeding decades of life. Strong found that about 50 per cent of the interests expressed by his subjects changed between the ages of twenty-five and thirty-five, about 20 per cent between thirty-five and forty-five, about 30 per cent between forty-five and fifty-five. There was little fluctuation of interest between the ages of fifty-five and sixty-five. Figure 70 presents Strong's curves showing certain fluctuations in interests between the ages of twenty-five and fifty-five. Some of the items listed are liked at all ages, others are disliked at all ages. For example, the occupation of undertaker is generally disliked by young and old; the *National Geographic Magazine* is generally liked. On the other hand, the curves show many interests which increase with age (dotted lines) and numerous others which remain about constant or decrease (solid lines). Fields of activity which demand marked physical skill and daring show pronounced changes in popularity with age. For example, the interest in such occupations as aviator and explorer declines with age, doubtless because the younger men are physically more fit for these vigorous activities. Older men, again, dislike items suggestive of change or interference with the established order.

In general, interest in all occupations, including one's own, shows a decline with advancing years. Interests in activities which involve reading manifest an increase with age, whereas those which involve talking or writing decline with advancing years. It is worth noting that older men prefer amusements pursued alone rather than group activities. Also, as men grow older they become more discriminating in their likes and dislikes for people, showing an increasing preference for those with traits which they regard as desirable, and a growing aversion for those with qualities which they consider unworthy.

There was no appreciable difference, Strong found, in the number of items liked or disliked at the ages of twenty-five, thirty-five, forty-five, and fifty-five;

At age twenty-five, 35 per cent of all items were liked; 30 per cent disliked.

At age fifty-five, 34 per cent of all items were liked; 31 per cent disliked.

The older men, therefore, had as many likes and dislikes as did the younger ones, or at least indicated as many on the test blanks. The older men did not develop more interests with increased age, as one might expect, nor were they more catholic in their interests than the younger men. The interests of the younger men were simply different from those of their elders. This means, in general, that the acquiring of new interests goes hand in hand with the abandonment of old ones. It is plain that this must of necessity be the case, unless one's waking hours are to become a hodgepodge of diversified activities shifting kaleidoscopically with increasing speed as age advances.

Instead of asking why an interesting activity continues with advancing age it might be more instructive to inquire why, in so many cases, it finally ceases. Why, for example, does a boy actively engaged in stamp-collecting lose interest in this hobby and stop collecting? As a man of forty he doubtless retains all the neural organization needed for stamp-collecting, but this organization has become inert. There is no dynamically active determination, no motive to call it into function.

A fading interest is similar to a perseverating experience (pp. 249-251). To illustrate the similarity, consider a man and his wife who have just returned home from a formal reception. They find themselves discussing the gowns, the couples present, the refreshments, the music, and so on. Gradually, however, as days and weeks pass, the perseverating images die away; they fade into nothingness. This fading of memory pictures is inevitable because countless other experiences occur to crowd them out. The more recent, intense, vivid, and emotional experiences clearly have the advantage in memory.

In the case of the fading interest the process is very much the same, but on a grander scale of time. The interesting activities of childhood, for example, are diverse and numerous. Inevitably some must be crowded out of behavior as an individual grows older and as new demands of time and consideration are made upon him. The new activities make dominant claims upon the muscles and neural

organization of an individual. Inasmuch as the organism reacts in an integrated, coordinated manner, one activity of necessity eliminates others.

Another factor is satiation (pp. 248-249). There is such a thing as having had enough, for the time being or permanently, of a given activity. It is well known that the repetition of an interesting activity sooner or later reduces the pleasantness an individual obtains in carrying it out.

THE HEDONISTIC EXPLANATION OF LEARNING

In respect to interests the hedonistic principle of motivation is uncritically assumed; it is commonly taken for granted that the pleasantness of an activity carries it along or somehow determines its continuance. There is at least one other place in contemporary psychology where the hedonistic principle comes into the picture, and that is in connection with the law of effect.

The Law of Effect. One of the most widely discussed principles of human and animal learning is the law of effect. Thorndike expressed the law as follows: a satisfying state of affairs is one which the animal does nothing to avoid but rather seeks to attain and preserve; an annoying state of affairs is one which the animal endeavors to avoid or change. If the effect of a reaction is satisfying, the reaction is stamped in, *i.e.,* learned; if the effect is annoying, the reaction is stamped out. Satisfying and annoying effects are thus vital factors in the process of habit formation.

In discussing this principle it is important to note that a reaction may have any of several different effects. In the first place, if an organism receives a scratch, cut, burn, or other *injury to the tissues* in the course of its own activities, this is an effect of reaction. For example, if a man cuts himself while shaving, the cut is clearly an effect of the reactions of shaving. Another kind of effect is the *relief of body need* when some consummatory reaction is made. For example, water relieves thirst and restores homeostasis—a physiological effect with psychological implications. A third effect of a given reaction is *success or failure* relative to some definite goal. In the everyday life of man, success in attaining a job, making a sale, winning applause, completing a difficult task, brings satisfaction and modifies future behavior; also failure has its profound

effects. In the laboratory the words "right" or "wrong," called out by the experimenter, mark success or failure in the task. In animal learning the attainment of a food goal and the receiving of an electric shock are both effects of reaction which can readily be interpreted in terms of success and failure. A fourth and very obvious sort of effect is *pleasant or unpleasant feeling*. For example, when a baby sucks his thumb the effect is obviously pleasing; if the same thumb is thrust into the fire, the effect is displeasing. Subsequently he repeats the former act and avoids the latter. A fifth effect of reaction is merely the *positive or negative behavior* induced by a situation considered quite apart from any pleasantness or unpleasantness and apart from the other effects listed above.

The effects mentioned overlap and are interrelated in many ways. In any adequate discussion of the law of effect, therefore, the first prerequisite is to state precisely what is meant by effect. Although there is no doubt that to most people Thorndike's terms "satisfaction" and "annoyance" immediately suggest felt pleasantness and unpleasantness, Thorndike himself has recently denied that satisfyingness and annoyingness are synonyms for sensory pleasure and pain. He defines effect entirely in terms of positive and negative behavior.

The pleasure-pain theory of learning found in the writings of Spencer, Bain, Baldwin, and others, is essentially the same as Thorndike's much-discussed law of effect. But according to the view of these writers, *pleasure* and *pain* are the effects of reaction which produce learning. It is clear, however, that animals cannot describe their pleasant and unpleasant feelings. Consequently, in the experiments upon animal learning, at least, Thorndike's behavioral criterion of satisfaction and annoyance must be used. Satisfaction is positive, consummatory behavior; and annoyance is negative, avoiding behavior.

Ample evidence that both positive and negative behavior lead to learning has been presented in the section upon rewards (pp. 290-306) and in that upon punishments (pp. 278-290). The experiments there recounted confirm the common beliefs of the parent, the educator, the animal trainer, all based on their various practical experiences.

Additional evidence bearing directly upon the law of effect is

found in experiments in which animals are given a free choice between several possible reactions. Such experiments show how one response comes to dominate another according to their respective effects upon the subject. The work of the Chinese psychologist Kuo, upon the elimination of unsuccessful acts, is presented here to illustrate how relative effects of reaction enter into learning.

Kuo gave rats a choice among four entrances within his apparatus. One entrance led directly to the food-box by a short path. Another led to the goal by a longer, indirect path. A third led to a compartment in which the rat, if he entered it, was confined for twenty seconds. When released he could go to food either through the short or the long path. The fourth opened into a compartment in which the rat was given an electric shock, after which he could approach food *via* either the short or the long path.

Kuo assumed that the animals would eliminate first the ill-adaptive reactions and that the order of elimination would vary with the degree of ill-adaptiveness. Accordingly, the expected order of elimination would be: first, painful shock; second, confinement; third, long path. Kuo assumed also that in some cases the excessive movements of approaching through the long path might not be eliminated at all. What did he find?

After experimenting with a group of thirteen black-and-white rats Kuo discovered that his predictions were all confirmed. The shock compartment was avoided sooner than any of the other compartments; the confinement compartment, on the whole, was eliminated sooner than the long-path compartment; and lastly all but two of the thirteen rats finally chose the shorter path, in many cases the shift from long to short pathway coming suddenly, despite the fact that there had been a greater frequency of runs down the long path prior to the shift.

In this experiment the ultimate goal was food, and the constant motivation, hunger. On the road to the goal different reactions had various effects; and these reactions, as predicted, were eliminated in proportion to the undesirability and the severity of their effects.

Another experiment which illustrates the predominance of one reaction over another according to its effect is the writer's work upon food preferences (pp. 109-113). Several food substances were

found to arrange themselves for each rat in a given sequence, most clearly expressed thus: milk > sugar > wheat > butterfat > flour.

When a pair of foods, such as sugar and wheat, was presented to the animal repeatedly the preferred food (in this case sugar) was selected with greater and greater frequency as the trials continued. Gradual changes in preferential behavior favoring the more preferred of the two foods appeared so regularly and consistently that we designated them "preferential trends." The animal learned, as it were, more and more to select the preferred food.

A hint that similar trends occur when a choice is given between two basic drives is found in the work of another experimenter. Using the method of choice (pp. 90-91), Tsai found that after a twenty-four-hour period of food deprivation male rats selected food in preference to receptive females in about 77 per cent of the trials. In his conclusions he stated that the number of food choices increased slightly with repetition of the choice-situation, which fact he regarded as additional evidence for the preference of food to sexual satisfaction under his conditions. In other words, the prepotent reaction dominated with increasing frequency when the choice-situation was repeated.

These experiments of Kuo, Young, and Tsai agree in one respect which can be stated as a general principle. When an organism is given a free choice between two courses of behavior which differ in their degree of satisfyingness or annoyance, upon repetition the more highly satisfying (or the less annoying) dominates behavior with increasing frequency. The gradual trend in preferential behavior can be referred to the *effect* of reaction. The formulation of the law of effect should go further; it should take account of the degree of satisfaction and annoyance. Possibly the Yerkes-Dodson law (pp. 280-287) can be interpreted in this light as a quantitative, though partial, law of effect.

Pleasant and Unpleasant Effects. As we have just seen, Thorndike's law of effect, stated in terms of positive and negative behavior, has been demonstrated as a valid principle of animal learning. The older pleasure-pain theory of learning was stated in terms of human feeling, and was uncritically assumed to apply in about the same form to animal behavior. Today psychologists have become skeptical of the kind of psychology which speculatively assigns con-

scious experiences to animals and which explains their behavior by an analogy to human consciousness. When we turn to the human individual, however, direct reports of pleasantness and unpleasantness are obtainable in addition to objective observations upon positive and negative reactions.

In the field of human psychology a considerable number of experiments have been made upon pleasant and unpleasant feeling in relation to learning, retention, recall, and other aspects of memory. A good deal of this work, unfortunately, rests upon a faulty formulation of the affective problem. A few of the sources of error commonly met in this work will be noted in passing.

If a subject reacts positively, this does not necessarily mean that pleasant feeling was experienced; and the same is true for a negative reaction and unpleasantness. There is a difference, which is frequently and mistakenly ignored, between "accepting" and "accepting with pleasure."

Again, if a subject reports that a word is pleasant or that a given past experience was unpleasant, he may be stating the purely cognitive aspect of experience with little or no reference to feeling. For example, when one remarks, "This is a pleasant day," one does not necessarily imply that pleasant feeling is now being experienced. Possibly during the course of the day the brightness and warmth, the highly saturated blues and greens of nature, together with the sense of rejuvenation and well-being elicited thereby, did induce pleasant feelings on repeated occasions; but the bare statement, "This is a pleasant day," does not report or describe existing affective experience. Failure to draw this distinction between *meaning* and *affective experience* leads to some of the well-known contradictions within affective psychology.

Another source of error lies in the fact that the precise relationship between a particular felt experience and some important existing condition cannot always be clearly defined in the experiment. For example, seeing a bottle of perfume may lead to the response of grasping and smelling, with a distinctly pleasing effect. If the same response occurred during an unpleasant mood, or along with a pleasing memory or thought, the affective experience would be so complicated by these extraneous conditions that any simple connection of feeling with reaction would be rendered impossible. An experimenter must define precisely what felt experience is being studied, delimit its conditions rigidly, determine its exact relation to

the bit of behavior under consideration or to the neural organization of the subject. This, of course, is easier said than done.

Despite the above difficulties and sources of error, the law of effect, from the standpoint of individual experience, can be validly stated in this way: if the conscious effect of a given reaction is pleasing to the individual, the reaction on the whole is likely to be repeated in a similar situation; if the effect is displeasing, the reaction is less likely to be repeated.

The Experiences of Success and Failure. In the present connection we should consider some of the conditions determining a sense of succeeding or failing in one's task. In an interesting investigation, Hoppe has shown that the experiences of success and failure are relative to the "level of aspiration" of the subject. Thus, if Paderewski played a few wrong notes during a concert, he would be much disturbed by his "failure," whereas an ordinary pianist would be greatly elated by his "success" could he play nearly as well. One's goal or level of aspiration, as just stated, is what counts in estimating success and failure.

The young child has no experience of failure when he is unable to accomplish what an older child or an adult can do with ease. Again, if the task is much too easy, its accomplishment does not bring the sense of being successful. Success or failure is relative to ability. If the task to which a child aspires is within the zone of his ability, its performance brings the experience of success. Sometimes parents and teachers make demands upon a child which raise his level of aspiration distinctly above that warranted by his ability. In this case a feeling of inferiority develops, to the detriment of the child's general conduct and his achievement. In other words, what constitutes success or failure is not merely the performance or non-performance of a given task, but rather achievement relative to the subject's real or imaginary goal.

Acquiring Likes and Dislikes. The law of effect, whether stated in objective terms or in terms of individual feeling, implies that an organism acquires organization which predisposes it toward some objects or situations and away from others. An illustration is found in the discrimination experiment. After a period of training on a T-maze, an animal learns to avoid punishment and to reach

the reward. Almost any light, sound, tactual impression, or other pattern of sensory stimulation, may serve as the signal for a positive or a negative reaction at the fork of the pathway. After the animal has learned to discriminate, the signal induces a response which originally it did not evoke; it becomes a cue to the animal to turn towards or away from something. This is the simplest laboratory illustration of building up a positive or a negative reaction.

In human psychology, too, it is well known that predispositions to like and to dislike are acquired. Moss has described an experiment with a two-year-old boy in which a dislike was built up in the laboratory. Billie was blindfolded and given orange juice sweetened with sugar. This was dropped on his tongue with a medicine dropper for six trials, but on the seventh trial vinegar was substituted. Immediately upon tasting the vinegar he began spitting, shook his head, gritted his teeth, and seemed to shiver all over; then he cried. On the eighth trial he was again given orange juice. Tears were dried and the investigation proceeded with orange juice for five more trials. On the next trial (the fourteenth) the vinegar was repeated, and this time synchronously with the sounding of a telegraph snapper which he had previously been playing with and clicking enjoyably. There was the same reaction as on trial seven. Orange juice was again given for four trials; then vinegar and snapper were presented simultaneously just as on the fourteenth trial. On the second day it was found that the snapper, even when presented with pure water, gave the conditioned reaction of dislike. In other words, the liking for the snapper was experimentally converted into a disliking; the boy's attitude toward the snapper had been completely changed.

In everyday life one frequently is unaware of the way in which likes and dislikes have been acquired. Names, faces, objects, colors, events, activities, etc., are often liked or disliked—but what is the basis of these reactions? Sometimes a careful psychological analysis reveals the explanation for liking or disliking something, as in the following instance described by Tait, which demonstrates how an apparently trivial dislike for a color was based upon an emotional experience of childhood. During an experiment it was found that some subjects had strong likes and dislikes for colors. One subject

could give no reason for his marked dislike of the color brown. In studying the case these instructions were used:

"Take the word 'brown' . . . and write it down five times with as much concentration of attention as possible. Then start the metronome at about forty and write a word for every beat. . . . Give yourself a free hand as much as possible. A passive state will aid you."

Among the words recalled and listed, "blood" occurred frequently. The dislike was finally traced back to a childhood experience described in the following report:

> It reverts to childhood, just the year I cannot say, but it was between the age of seven and ten. I was visiting my grandmother (summer time), and a swing had been constructed in the barn, where I and my two playmates spent most of our time. As I look back now that barn was a most mysterious place to me—very mysterious—full of pits and rats. Yet in the daytime we explored it without fear. Late one afternoon, while I was swinging alone, one of the ropes broke and I took a bad fall backwards, hitting my head a glancing blow on a floor support. I remember, now, distinctly, my dazed condition as I turned to look at what I had hit, and saw drops, several of them, of reddish-brown blood. Brown, I suppose, because I was somewhat dazed. I quickly put my hand to the back of my head and found it wet. I had given myself a rather severe cut on the scalp, and it was bleeding badly. I remember the unusual feeling of my fingers as they touched the bruised spot wet with blood. It was the first time, so far as I can recall, that I had personally come in contact with blood. In real childhood fear, I jumped up, crying, and rushed to my grandmother. When I went to the barn next day those spots were brown. . . .

The subject explained his distaste for brown by referring to that strong emotional experience of childhood. Each one of us has unexplained likes or dislikes, the origins of which lie in obscure past events.

The Acquired Basis of Affective Reactions and Value Judgments. After one has learned to like or to dislike something, a modified neural organization remains which predisposes the individual to react positively or negatively towards that thing. This is true of simple sensory presentations, as in the foregoing example

with Billie. One also learns to react positively or negatively to more complex situations, such as playing golf, working crossword puzzles, taking an auto trip, voting for a republican candidate, and so on. In the sphere of highly complicated ideas—concerning prohibition, the church, the republican party, the theory of biological evolution, capital punishment—one has biases pro and con. The term "attitude" has been applied to the mental organization which predisposes an individual to react favorably or unfavorably toward some stated proposition (p. 242).

The mental organization remains latent until some event calls forth a reaction. Then it determines the direction in which the individual will turn, just as the railway track determines whether the train will turn right or left.

Neural, or mental, organization predisposes not simply towards or away from, but *strongly* or *weakly* towards, *definitely* or *hesitatingly* away from. That is, it can evoke varying degrees of positive or negative response. Moreover, it renders possible those fine distinctions of relative value implied in such statements as: "The fragrance of orange blossoms is more pleasing than that of lilacs." "To tell a lie is sometimes more highly moral than not to tell one." "The music of Beethoven is more highly developed in form than that of Mozart."

Value judgments such as the above depend upon a whole series of discriminations within some limited range of experience. Whether it concern literary merit, soundness of business policy, esthetic beauty, scientific correctness, or political maneuvering, the ability to discriminate between better and worse is built up within one gradually through persistent activity within the restricted area of experience. How is the neural organization which dominates these judgments built up?

Habituation doubtless plays an important rôle in developing the processes of evaluation. For example, an individual who is thoroughly accustomed to clean table linen and carefully prepared food would place a very low value upon the greasy meal and rough board of a poor mountaineer in an environment of pigs, chickens, and flies. Yet the mountaineer, accustomed all his life to the simple, crudely prepared food, eats the same meal with relish and values it highly. The esthetic evaluation of the meal obviously depends

upon previous experiences of the individual. The daily life of college students also affords an apt illustration of this principle. A consistent grade *A* student is much distressed at receiving the grade of *C* in one of his courses, whereas on the other hand, a poor student who was expecting a failing grade of *E* in a given course is delighted to receive the passing grade of *D* instead. Similarly, one's judgment of pleasantness or unpleasantness for any kind of sensory material depends upon what has gone before. A pleasant odor, as previously noted, is reported more intensely pleasant when it follows a group of unpleasant odors than when it stands alone, and similarly an unpleasant odor becomes more intensely unpleasant when it immediately follows pleasant odors than when it stands by itself.

Washburn has stated the principle of affective contrast in the following words: "The pleasure of an agreeable experience is heightened if it is preceded by a disagreeable experience, and an impression in itself unpleasant may be felt as pleasant if a more unpleasant state has been its antecedent. In like manner unpleasantness may be heightened or even created through contrast with a preceding agreeable affective state. These are laws of the affective life which everyday experience has established."

In order to determine how an affective judgment varies with previous judgments on materials which belong to the same unitary group, or *Gestalt*, Beebe-Center performed an interesting experiment with odors. The following diagram aids in understanding the plan of the experiment:

(1) *a b c d e*....... initial values
(2) *a b c d e*.... values after habituation to *a* and *b*
(3) *a b c d e*.......... values after habituation to *d* and *e*

(4) −4 − 3 − 2 − 1 0 + 1 + 2 + 3 + 4

A group of odors (*a, b, c, d, e,* line 1), was selected so that judgments would be distributed normally over the scale of affective values represented in line 4.

One experiment consisted of first habituating the subjects to affective judgments with unpleasant odors, *a* and *b*, and then testing their affective judgments for the entire series. Although *c*, *d,* and *e* were not presented in the habituation or "determination" series, a

test showed that the entire group of odors had shifted toward greater pleasantness, as indicated in line 2. Another experiment consisted of habituating the subjects to affective judgments with pleasant odors, *d* and *e*, and later, of testing the complete series. After this kind of preliminary "determination" the entire series shifted toward greater unpleasantness, as shown in line 3.

In other words, the affective judgment of a particular odor was found to depend in part upon all previous judgments of those odors which, with it, constituted a unitary group. The shifts which Beebe-Center demonstrated were assumed to depend upon dynamic changes within the neural mechanism which determined the value judgment. In general, one's total experience with a class of materials builds up a neural basis for evaluation of those materials.

THE NATURE OF PLEASANTNESS AND UNPLEASANTNESS

Psychological hedonism assumes that felt experiences (pleasure-pain) are motives. It teaches that we continue activities which are pleasing and avoid unpleasant ones; that we learn to do those actions which bring pleasantness and to eliminate those which induce unpleasantness. In considering the hedonistic doctrine, therefore, we should examine the nature of pleasant and unpleasant feeling.

When a subject reports "pleasant" or "unpleasant" in the course of an experiment he refers to individual conscious experiences. This fact cannot be avoided. The terms "pleasant" and "unpleasant" refer to conscious experiences as truly as do "red," "green," "pressure," or "cold."

What is the nature of the felt experience to which the terms "pleasant" and "unpleasant" refer? Unfortunately the question cannot at present be answered scientifically, despite the fact that numerous attempts have been made to do so. It is one of those questions the answer to which is still scientifically indeterminate.

The history of psychology teaches that many views regarding the nature of felt experience have been held; it is futile to discuss here the relative merits of these varied opinions, because up to the present time no single view has won general acceptance. It is instructive, however, to ask: "What has been the trouble with the controversies and experiments upon the nature of felt experience?"

The fundamental difficulty can be made clear by an analogy to

one of the dot figures which are so well known in the field of perception. Let the eyes move at random over the following pattern of dots:

Groups of twos, threes, fours, fives, etc., are readily observed; simple and complex patterns appear. With proper mental set one can see large and small groupings, regular and irregular, and perhaps no grouping at all. Seemingly an indefinite number of configurations are observable. So in affective psychology the facts may be envisaged in different ways. Trouble begins when one attempts to say which view is true and which is false; this is like arguing that the dots are actually grouped by threes or by fours, in this way or in that.

One can seek an answer to the question as to the ultimate nature of felt experience either through reflection or through observation. In the latter case a curious situation arises in which any one of a number of possible views may appear to be correct, with no scientific criterion for determining whether one view is ultimately more valid than another, or whether all are equally true. Quite possibly all views are true or partly true just as the dots are truly arranged in various ways. To illustrate the contending views, five of the more important contemporary theories will be presented below.

1. If one attempts to observe his own pleasant or unpleasant feeling directly, these experiences are found to be elusive. One observes some sensory process or pattern such as pressure or pain, but no unique feeling, no mind stuff. The affective experiences are merely felt and reported; they cannot be attentively observed, but vanish as soon as one attempts to put a finger upon them. Because of this difficulty a view has arisen that *pleasantness and unpleasantness lack the attribute of clearness or vividness* which characterizes sensory processes (Titchener). The view gives rise to an experimental set-up in which the subject merely feels and reports without attempting to perceive *what* is felt. Subject and experimenter alike, both ad-

herents of this view, approach felt experience with the assumption that affective processes are impalpable, not observable as are sensory processes. If one claims, on the contrary, that the subject's report of a pleasant feeling after smelling a particular perfume is an observation, one must clearly understand that it is not the same kind of observation as that made with the eye, ear, or hand.

2. From time to time, however, the above hypothesis has led to dissatisfaction among psychologists, which has resulted in the formulation of another view. According to this view, it is claimed that *pleasantness and unpleasantness are truly sensory in nature* and that they are attentively observable. A recent form of the sensory view which is supported by experimental evidence is that of Nafe. According to Nafe, pleasantness and unpleasantness, when directly observed, are sensory processes resembling pressure—pleasantness, a bright pressure; and unpleasantness, a dull pressure. The view is stated in the following words:

"Pleasantness, as a psychological experience, consists of discrete bright points of experience in the general nature of a thrill but usually much less intensive. It is vaguely localized in the upper part of the body and quickly adapts or fatigues. Unpleasantness is similar but characteristically duller, heavier, more of the pressure type of experience and is localized in the abdomen or in the lower part of the body."

The obvious comment about this hypothesis is that, if the subjects approach affective consciousness predisposed to observe something sensory, the chances are they will succeed in observing sensory processes. The important question, however, is whether the observed processes can truly be identified with pleasant and unpleasant feelings.

3. Still another view of the problem is one which is quite common in daily life, but rare among contemporary psychologists. The view is that *pleasantness and unpleasantness are attributes or characteristics of certain sensations.* Just as two tastes may differ in quality (*e.g.,* sweet, bitter, salt, sour) and intensity (*e.g.,* weak salt, intense salt) so they may differ in feeling-tone (pleasant, unpleasant). That is, the pleasantness of the sweet taste is an attribute of the taste itself.

This view was held by Ziehen, and at one time by Wundt, who later, however, changed to the first view. It agrees with everyday habits of speech which refer feelings, moods, and emotions to some

sensory presentation. Thus one speaks of the pleasantness of a perfume, the unpleasantness of a cold temperature, and so on.

4. A fourth view is that *pleasantness and unpleasantness designate value judgments based upon acceptance or rejection.* Carr has developed this judgmental conception of pleasantness and unpleasantness. If a stimulating situation, uncomplicated by secondary motivating factors, induces a positive reaction, it is judged pleasant; if it evokes a negative reaction, unpleasant. The affective judgment rests upon normal uninhibited reactions.

The way in which objects and events affect the subject is indicated by such statements as "The object is pleasant," "*X* is more pleasant than *Y*." These judgments are based upon incipient or overt reactions which give the affective meanings.

5. Beebe-Center, realizing the complete lack of agreement concerning the existential nature of pleasantness and unpleasantness, defined hedonic tone as a *concept* referring to felt experience. For him, *pleasantness and unpleasantness are respectively the positive and negative values of a single algebraic variable, hedonic tone.*

Now which of the above views shall we accept? Every one has been taken seriously by competent psychologists. Every one has experimental evidence which can be mustered to support it. These views have been argued pro and con, and there are still others and various modifications of these which might be added to the list. The question, "Which view is true and which false?" is beside the point, for there is apparently no way to answer it by appealing to experimental evidence. The attempt to determine the ultimate nature of pleasant and unpleasant feelings is a *cul-de-sac* in a scientific maze.

The trouble is not that any one doubts the existence of pleasant and unpleasant feelings, but rather that the apparent nature of these feelings is to such a high degree made or molded by the attitude of the individual subject. As with the dot figures, it is best to recognize that the apparent nature of pleasantness and unpleasantness is relative to the subject's attitude. This view of the problem may be designated *attitudinal* because it stresses the importance of the attitude of an individual in defining the nature of felt experience. The attitudinal view at first appears to be negative, but actually it offers a positive basis for evaluating the historical controversies which have arisen over the nature of affective consciousness, and

it offers also a constructive program for laboratory investigations of felt experience in which the attitude of a subject is a prime condition (pp. 365-378).

Fortunately the unsophisticated subject who smells an odor and reports "pleasant" or "unpleasant" is not troubled by questions of systematic psychology. To him the ultimate nature of pleasantness and unpleasantness is neither more nor less of a problem than the ultimate nature of red, or pain. The care-free subject merely takes a whiff and says "pleasant," "unpleasant," or "indifferent," and to him "little can be gained," as some wag once said, "by an attempt to unscrew the inscrutable!"

Regardless of one's systematic views upon the nature of pleasantness and unpleasantness these experiences are among the facts or data with which the psychologist deals. They are not in any sense physical processes. Hence they are not *causes* of bodily movement.

For the rest of this chapter we will hold to a matter-of-fact, *process* view of the affective experiences. From this standpoint we will consider the following topics: the nature of simple affective reactions to stimulating objects; pleasant and unpleasant feeling in relation to muscular activity; the mental conditions of pleasant and unpleasant feeling; preferential discriminations. We will conclude the chapter with a statement concerning the relation of pleasant and unpleasant feeling to motivation.

SIMPLE AFFECTIVE REACTIONS TO STIMULATING OBJECTS

Suppose we have before us the following objects: (*a*) a lump of sugar, (*b*) an intense quinine solution, (*c*) a bottle of old rose perfume, (*d*) a bottle containing decaying flesh, (*e*) a soft, warm ball of cotton, (*f*) a needle for puncturing the skin. If these and similar objects be presented to the tongue, nose, or skin, as the case might be, the normal subject, who has been instructed to indicate his liking or disliking for the presentations, will report that (*a*), (*c*), and (*e*) are pleasing and that (*b*), (*d*), and (*f*) are displeasing. A demonstration of this kind reveals directly and convincingly the central problem of affective psychology.

In general, an individual is likely to regard as pleasing and displeasing the following kinds of experience, respectively:

Pleasing	Displeasing
Tasting sugar	Tasting bitter medicine
Smelling flowers, fruit, and savory foodstuffs	Smelling decaying flesh
Feeling warmth when cold	Feeling pain from injury
Feeling coolness when heated	Enduring organic pains in hunger, thirst, and disease
Sexual excitement under appropriate conditions	

Thus some stimulating objects quite consistently evoke the descriptive words "pleasing," "agreeable," "acceptable," whereas others call forth the report "unpleasant," "disagreeable," "unacceptable." The significance of the difference is guaranteed both by individual consistency of report over a considerable period of time and by the statistical constancy of affective reports when various groups of subjects are tested.

So long as we limit ourselves to a consideration of stimulating objects, and to the verbal or gestural reports of liking and disliking, made by carefully instructed subjects, we are on sure ground. When, however, we inquire about the fundamental basis of these reports of liking or disliking, we find ourselves confronted with different interpretations. On the one hand, the laboratory subject commonly believes that his reports of liking and disliking are based upon pleasant or unpleasant consciousness; he regards the verbal statements as meaningful communications of affective experience. The objective psychologist, on the other hand, assumes that the words "I like it" and "I dislike it" are symbols for positive or negative behavior, or else that they are based upon some physiological processes in the nerves and muscles. These interpretations are all valid. The first presupposes the viewpoint of the consciously experiencing individual; the last two, that of the objective psychologist.

In everyday life, of course, the reports of liking and disliking are generally given without any reference to the affective reactions upon which they are based. As a matter of fact, the average man who smells a rose and says "I like it" would consider it foolish to inquire why that particular fragrance is liked. To designate the organic processes upon which reports of liking and disliking are based we will use the words "affective reactions."

Affective Reactions to Taste Solutions. In an experiment upon the sense of taste, Saidullah studied the relationship between reports of pleasant and unpleasant feeling and the concentration of taste solution. In one series he used eighteen solutions of table salt varying in concentration from 0.5 per cent to 30 per cent. The subject was instructed to take a gulp of a given solution and then to

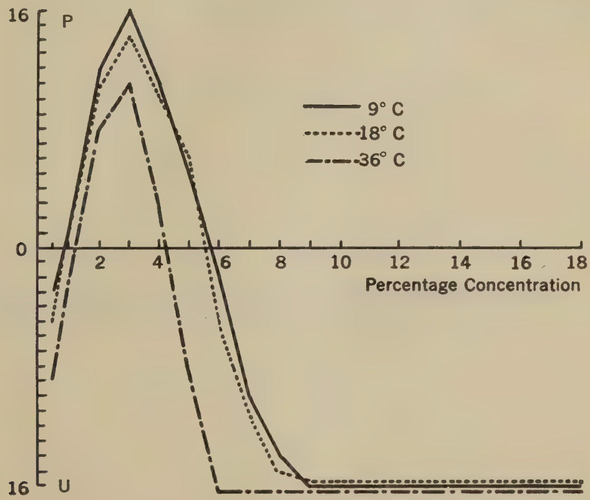

FIG. 71. CONCENTRATION OF SALT SOLUTION IN RELATION TO REPORT OF PLEASANT AND UNPLEASANT FEELING. (*After Saidullah.*)

The horizontal line gives the percentage concentration of the salt solution up to 18 per cent. The vertical gives the difference between frequencies of pleasant and unpleasant feelings as reported.* Three temperatures were used.

report his affective experience, disregarding so far as possible the sensory quality and intensity of the taste.

The solutions were arranged in two equivalent series with strong and weak intensities in irregular sequence. Two series were given at different times to eight subjects, which yielded sixteen judgments per solution. Figure 71, which presents the results graphically, gives concentrations of salt solution for abscissae, and for ordinates the differences between frequency of pleasant and unpleasant feelings as reported by the subjects. The curve shows that there is an optimum salt concentration for pleasantness somewhere between 2 and

* The terms "pleasant," "pleasing," "pleasantness" are conventionally represented by *P* and the terms "unpleasant," "displeasing," "unpleasantness" by *U*, and indifference by *I*.

3 per cent. It shows, further, that very low concentrations are slightly unpleasant or indifferent, and that between 3 and 7 per cent there is a very rapid transition from pleasantness to unpleasantness. Solutions above 9 per cent were uniformly unpleasant for the eight subjects; values above 18 per cent, not shown on the curve, were all unpleasant.

Three temperatures of the liquid were used: cold (9°C), lukewarm (18°C), warm (36°C.) Of the three, 9°C gave the greatest

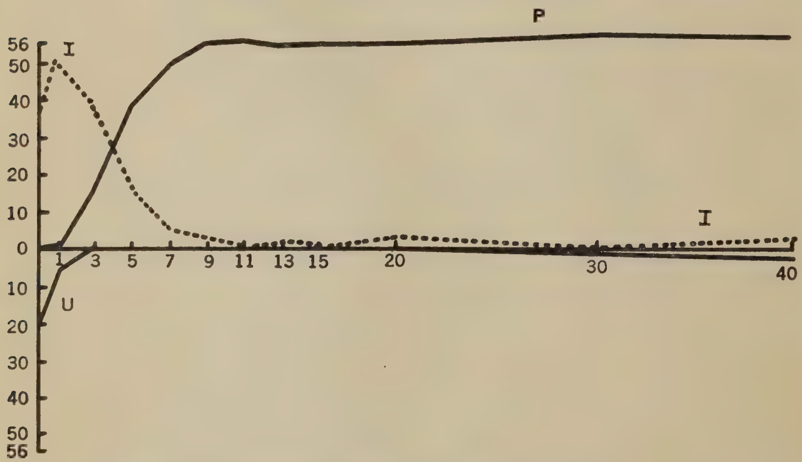

FIG. 72. CONCENTRATION OF SUGAR SOLUTION IN RELATION TO REPORT OF PLEASANT, UNPLEASANT AND INDIFFERENT EXPERIENCE. (*After Engel.*)

The horizontal line gives the percentage concentration of the sugar solutions. The vertical line gives the number of reports of pleasant, unpleasant, and indifferent feelings. The total number of responses was fifty-six for each solution, and the sum of all the responses equals fifty-six at every concentration.

frequency for reports of pleasantness. The results indicate that regardless of the temperature a concentration somewhere between 2 and 3 per cent is optimum for pleasant feeling.

A similar study with taste solutions was made by Engel. His curve for the different concentrations of salt solution confirms that of Saidullah given in Fig. 71. Engel's graphs for quinine and acid solutions approach 100 per cent unpleasantness as their limit, but the curve for sugar solutions is distinctly different. This curve, which varies with the concentration of sugar solutions, is reproduced in Fig. 72. Whereas very weak solutions elicited reports of indifference and occasional unpleasantness, with all concentrations

above 9 per cent the sugar solutions were reported approximately 100 per cent pleasant.

Sweets are notoriously agreeable to normal adults; they are especially well liked by children. Also in the writer's food-preference experiment, sugar was found to be strongly demanded by rats which were maintained upon a standard balanced diet. Figure 72 not only confirms this generally recognized fact, but it goes a step further. It shows that affective reactions are not lawless, as many people commonly suppose, but that they vary with the existing conditions in a fairly exact quantitative manner.

Affective Reactions to Olfactory Stimuli. Odors are serviceable in the study of pleasant and unpleasant experiences because olfactory stimuli evoke definite affective reactions. In experiments made by the writer with the collaboration of Emily Kniep and Winona Morgan, chemically pure organic substances, most of which were unfamiliar to the subjects, were presented under carefully controlled conditions. The ventilation and illumination of the experimental room, the printed instructions given to the subjects, the timing of each presentation, the intervals between presentations, and other conditions were all kept constant. The subjects were instructed to be passive and composed, to close the eyes during the time of smelling, and to report immediately whether they liked or disliked the odor presented in a given trial.

After a preliminary study of pleasing and displeasing smell-substances a series of sixteen suitable ones was selected for presentation.* The aim was to select olfactory stimuli which would give approximately a linear series ranging from zero to 100 per cent pleasantness. This series was presented to 100 college students under standard conditions. For every odor a percentage of pleasantness

* The following substances, to be designated hereafter by number, were employed:

1. Camphor.
2. Methyl salicylate.
3. Vanillin.
4. *p*-Dichlorobenzene.
5. Menthol.
6. Phenol.
7. Acetophenone.
8. Nitrobenzene.
9. Geraniol.
10. Ethyl cinnamate.
11. *n*-Caproic acid.
12. Quinoline.
13. Heptyl aldehyde.
14. *o*-Bromotoluene.
15. *di*-Phenyl ether.
16. Empty bottle.

Several additional substances were tried and rejected because of high diffusibility, or because they stimulated tactual nerves in the nose.

was computed, based upon the number of subjects reporting it as pleasant. The graph in Fig. 73 represents the odors ranked according to the percentage of reported pleasantness. How well we succeeded in selecting smell-substances which would give a linear distribution is shown in the figure.

Having attained this selection we next set about studying the constancy of affective reactions with subjects of different ages. The odors were presented to two groups of children. One group con-

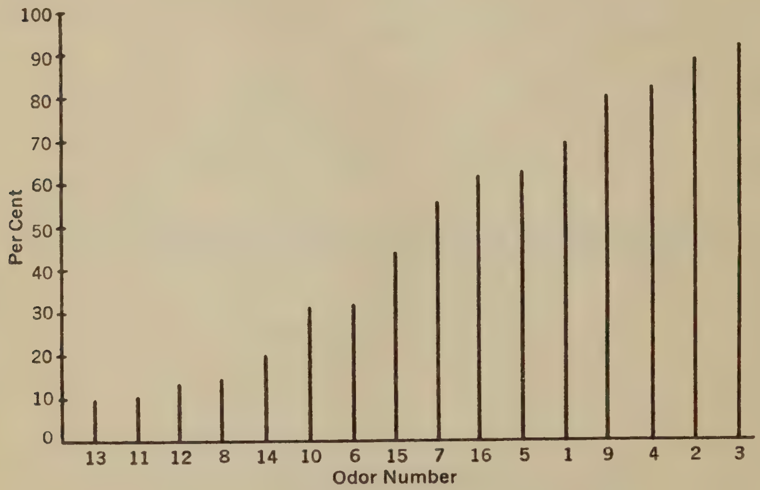

FIG. 73. PERCENTAGE OF PLEASANTNESS FOR ODORS. (*From Kniep, Morgan, and Young.*)
The length of a line indicates the percentage of 100 subjects reporting an odor as pleasing. Numbers at the base refer to the substances used, the names of which are given in a footnote, page 345. The odors are ranked from the least to the most pleasant. In computing the percentage of pleasantness a report of indifference was counted as ½ pleasant and ½ unpleasant.

tained fifty children, ages seven to nine; the other contained the same number, ages eleven to thirteen. It was found desirable with children to shorten the test series. Consequently the last two smell-substances of the regular series were dropped, fourteen remaining.

The results of the three series of tests are shown in Fig. 74. The solid line presents the odors ranked in order of pleasantness, from the highest to the lowest, on the basis of reports of adults. The corresponding values with the eleven-to-thirteen-year-old group (dotted line) and with the seven-to-nine-year group (dash line) are also plotted. The graphs reveal at a glance that affective reactions to

olfactory stimuli are to a high degree independent of age. The coefficients of correlation among the groups range from 0.91 to 0.98. The frequency with which an odor evokes a pleasant or unpleasant response is thus seen to be highly constant within the age limits of seven to twenty-four years.

These findings demonstrate that the bodily mechanisms which determine liking and disliking for odors are relatively mature at

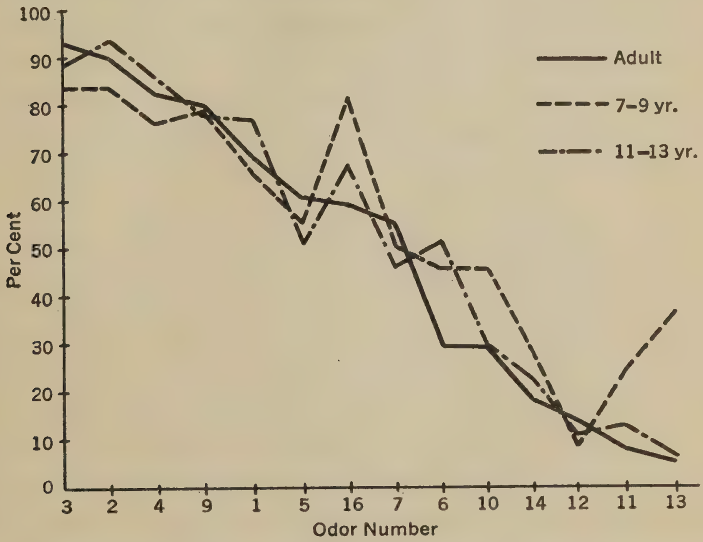

FIG. 74. RANK ORDER OF ODORS ACCORDING TO PERCENTAGE OF REPORTED PLEASANTNESS FOR DIFFERENT AGE GROUPS. (*From Kniep, Morgan, and Young.*)

The odors are arranged in a descending order of pleasantness on the basis of reports from 100 adults. The percentage of pleasantness is shown with 50 children, ages seven to nine, and with 50, ages eleven to thirteen.

the age of seven, especially in view of the fact that most of the smell-substances used were unfamiliar to the subjects. Hence association played a relatively small rôle—the likes and dislikes were determined mainly by innate factors.

One incidental result is of interest. Number 16 was not a smell-substance at all but rather an empty sterilized bottle presented for affective report in the context of odors. One might expect that the affective reports to this control would be about 50 per cent pleasant at all ages. As a matter of fact, the value was 61 per cent pleasant with adults, with the older children it was 67 per cent, and with

the younger children 82 per cent. The explanation of this curious finding probably lies in the position of the empty bottle in the series of odors; it came by chance immediately after several unpleasant odors. Now it has been demonstrated that a pleasant odor is more frequently reported pleasant when it follows unpleasant odors than when given alone. Similarly an unpleasant odor is more frequently reported unpleasant when it follows several pleasant odors. In other words, the position of an odor in a group is one factor in determining its percentage of pleasantness. There is every reason to believe that this contrast principle applies to the empty bottle in the context of pleasant and unpleasant odors; and that with children the principle is more pronounced than with adults. At least, this hypothesis offers a plausible explanation of the unexpected result.

A Test of Affective Sensitivity. Some individuals are hard to please; others are easily pleased. In other words, individuals differ in affective sensitivity. How can one test the readiness of a given individual to be pleased or displeased? If a subject reports that all or most of the odors in the above series are pleasant, he is obviously more readily pleased than an individual who reports only a few or none of them as pleasant. Of course, it is likely that some persons are harder to please in one field of experience, and some in another. Then, too, the same individual is more readily pleased in one mood than in another. These differences must be constantly kept in mind while considering the following results.

On the basis of the data obtained in the foregoing experiment, a percentage of reports of pleasantness was computed for every adult subject. One hundred per cent indicates that all sixteen odors of the series were reported as pleasant and none as unpleasant. Fifty per cent indicates that half were designated pleasant and half unpleasant, or else that all were reported as indifferent. The distribution of the percentages of reports of pleasantness for 100 adult subjects is given in Fig. 75, in which each subject's score is represented by a single dot. Toward the right are the scores of subjects most readily pleased and toward the left the scores of those hardest to please with odors.

With the two groups of children raw scores were plotted directly instead of converting them into percentages. The raw score is

merely the total number of presentations reported as pleasant plus ½ of the reports of indifference. Thus the maximum possible score is fourteen (all reported pleasant) and the minimum possible score zero (none reported pleasant). The distributions of these scores are presented in Fig. 76.

For all age groups the scores in the affective sensitivity test give approximately a normal curve of distribution. These curves show how individuals differ in their readiness to be pleased by odors. It is likely that the symmetrical shape of the above curves depends to

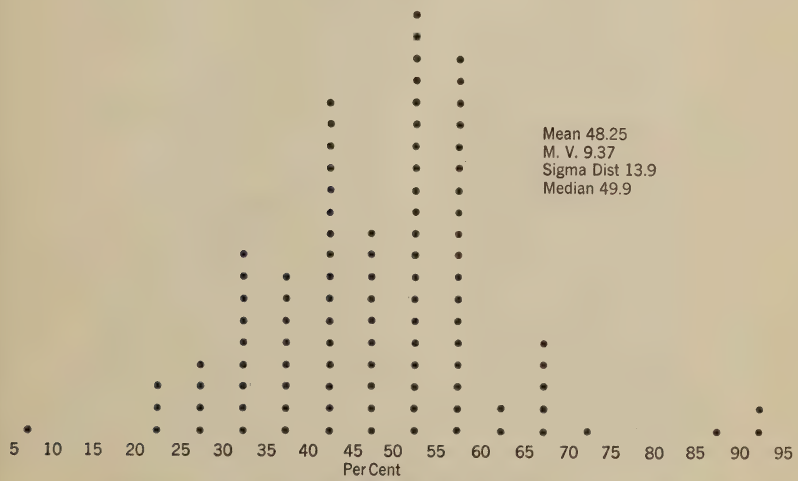

FIG. 75. DISTRIBUTION OF SCORES FOR 100 ADULTS IN AFFECTIVE REACTION TEST. (*From Kniep, Morgan, and Young.*)

The base line shows the percentage of the sixteen odors reported as pleasant. The verticals give the frequency of the various scores, a dot representing the score for a single person.

some extent upon the balanced selection of pleasant and unpleasant odors as stimuli for the test. With a group of presentations consisting entirely of markedly pleasant or markedly unpleasant odors the curves might easily be skewed towards one side or the other.

Affective Reactions to Thermal, Organic, Auditory, and Visual Stimuli. In discussing the nature of the transition from pleasantness to unpleasantness, Lehmann described a few observations in which the subjects dipped their fingers into water of varying temperatures. In one test there was an ascending series of discrete temperatures. Two fingers were dipped into the first water,

held there for five seconds, then transferred to the next higher temperature, and so on. In the other test the fingers were held in the water continuously for two minutes and twenty seconds while the temperature was gradually changing. In both tests a temperature of 35°C was reported as pleasant warmth and a temperature of 50°C as painful heat.

It is an interesting observation that unpleasantness appears somewhere between the temperatures of 40°C and 45°C, since this is

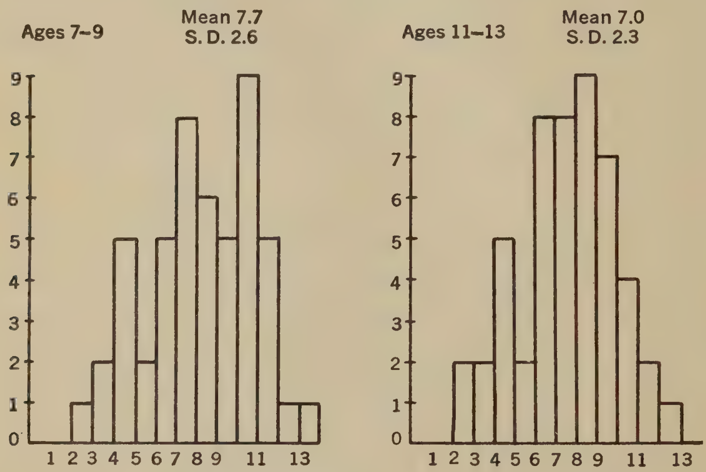

FIG. 76. DISTRIBUTION OF THE RAW SCORES MADE BY CHILDREN IN AFFECTIVE REACTION TEST. (*From Kniep, Morgan, and Young.*)

The base line shows the number of reports of "pleasant" in a series of fourteen affective reactions. The height of the verticals shows the frequency for each number of reports of pleasantness.

also the range of temperatures where warmth turns into sensory heat.* Between 45°C and 50°C pain excitation is added, and marked unpleasantness is associated with the painful or burning heat. These observations make it clear that warmth is pleasant and that heat is unpleasant—painful heat very markedly so. The experiment should be repeated with a greater number of subjects so that frequency curves showing the quantitative relationship between affective reactions and temperature could be plotted, similar to those shown in Figs. 71 and 72 for tastes. Lehmann's work points toward the

* Experiments have shown that sensory heat depends upon a physiological fusion of excitations from the cold and warmth spots.

existence of the same precise quantitative relationships between thermal stimuli and affective reactions.

Organic stimuli are known to evoke definite affective reactions. Muscle aches, gastric pains, nausea, chills and fever, hunger, thirst, and similar organic experiences are typically described as unpleasant; whereas relief from internal pressure, sexual satisfaction, rest and relaxation are typically pleasant.

It is an interesting fact that the most marked affective reactions come from those senses that have direct contact with the energies of the environment (touch, pain, temperature), from those that stand guard at the entrance to the alimentary tract (taste, smell), and from those that indicate internal bodily conditions (organic and kinesthetic senses). The distance senses (vision, hearing, and to some extent smell), on the other hand, function primarily in the observation of objects and situations for the purpose of making adjustments to them. These senses are the basis of the fine arts, but a discussion of pleasant and unpleasant feeling in the fine arts belongs with experimental esthetics rather than in this connection.

Very loud noises are painful and unpleasant. Some noises, such as the sound made by scratching the blackboard with one's finger nail, induce bodily reverberations of a highly unpleasant character. Musical tones and chords, on the other hand, are frequently pleasing. Dazzling and flickering lights are annoying. Highly saturated bright colors are pleasing to some; tints and shades at low saturation please others.

However, as stated above, the affective reactions evoked by simple tones and colors are much weaker than those evoked by odors, tastes, and cutaneous and organic stimuli. The colors used in painting and the tones in music do produce pleasing esthetic effects, but a great deal of esthetic appreciation depends upon one's training. Individual differences in appreciation of art are very marked. After years of careful study, von Allesh found that the beauty or ugliness of a color is highly variable, depending upon its background and other factors which constitute its esthetic context.

The Conception of Affective Reaction. The phrase "affective reaction," as stated above, designates the organic processes upon which the reports of liking and disliking are based. Our conception is that the affective reaction is a unitary process in nature. It may

be observed from various angles. Feelings of pleasantness and unpleasantness are the *subjective* aspect of the ultimate affective reactions. The *behavioral* aspect of the processes appears as the dynamic activity of accepting or avoiding, plus a lot of other expressive reactions—vocal outcries, facial expressions, muscular contractions, glandular secretions, etc.—which cannot readily be interpreted in terms of positive-negative behavior. Another aspect of affective reaction is the *physiological*. To the physiologist an affective reaction is a process within the subject's nervous system, muscles, and glands. This process may be some sort of blocking or inhibition for unpleasantness, and a release of blocking or facilitation for pleasantness.

Of course, the subject who reports liking or disliking is not concerned with the fundamental basis of his reactions. The psychologist also, starting from verbal reports of the subject, can investigate affective sensitivity, individual differences in likes and dislikes, interests, attitudes, and a host of other important topics without once questioning the underlying basis of the subject's reports. There is thus an uncritical, general meaning of the phrase "affective reaction" which is practically useful.

A question of fundamental scientific importance is this: What reactions bring pleasantness to the reagent, and what bring unpleasantness? Although the preceding pages have cited many examples of both types, the following *functional* classification gives a more complete answer to the question.

1. As regards *food-taking*, the activities of approaching food, bringing it to the mouth, acceleration of the salivary flow, chewing, swallowing, and other phases of the digestive process, are typically associated with pleasant feeling. On the other hand, movements of repulsion and avoidance, spitting food out of the mouth, gagging, vomiting, sometimes complicated by the flow of tears and reddening of the face, are characteristically associated with unpleasantness. Sweet substances usually lead to the positive or pleasure-bringing type of affective reaction; bitter, to the negative or displeasure-evoking type. Again, the same object may evoke positive behavior in one organism and negative in another. For example, I recall vividly the picture of a dog eating with apparent relish the carcass of a horse; to me the odor and sight of the horse-meat were nauseat-

ing. Thus, the dog reacted positively and I reacted negatively to the same food object. Again, the case of Jack Sprat and his wife needs no special comment. Then, too, the same individual may react with pleasantness at one time to something which, at another time and under different circumstances, he reacts to negatively or with complete indifference. The affective reaction to iced tea presented on a cold winter day and again on a hot summer day illustrates the point. A slice of bread and butter offered at the end of a full meal and again when hungry, further shows the relativity of affective reactions to conditions. Although there are innumerable food substances, there are only two dynamic behavior relationships with respect to them—accepting and eating, rejecting and avoiding. If neither of these dynamic possibilities is realized, as is likely to be the case when food is presented to a satiated individual, the affective experience is indifferent.

2. The *olfactory reactions* are closely related to food-taking and to sexual behavior. In general, the odors of foods such as fresh fruit, cooking meat, etc., are pleasing. The scents of non-edible flowers are agreeable; these odors in nature are associated with reproduction, in that they attract insects which fertilize the plant. All the pleasing odors evoke reactions of continued sniffing, sometimes complicated by smiling, closing the eyes, looking up, and approach. On the other hand, the odors from decaying foods are typically disagreeable; the reactions are inhibition of respiration, turning away of the head, shuddering, shivering, making faces, gutteral exclamations of disgust, and other forms of escape and rejection.

If an irritating substance such as pepper or ammonia gets into the nasal cavity, a sneeze occurs, sometimes complicated by a flow of tears, frowning, and other evidences of discomfort. The sneeze is a form of rejection; it clears substances out of the air passages. Curiously enough, however, the sneeze is also at times evoked by sudden bright light; here it is difficult to see how it can be considered as an avoiding reaction.

3. *Cutaneous* stimulations often evoke marked affective reactions. Cuts, burns, electrical shocks, stimulations from acids, and other noxious excitations lead to reflex withdrawal, and often to various secondary activities such as outcries of pain and writhing. These negative reactions free the organism from the injurious stimulations. On the other hand, soft, warm, smooth contacts usually evoke a pleasing reaction. The stimulation of sensitive zones brings the

tickle responses which characteristically are pleasing even though associated with a pseudo-withdrawal.

The relation between sensitive-zone responses and sexual behavior is debatable. According to Allport, the sensitive-zone reactions in the child are not at the start sexual, but as the individual develops they become integrated with truly sexual behavior patterns. The cutaneous contacts of sexual behavior are pleasing and associated with positive behavior.

4. Brief mention should be made of the *affective reactions to visual and auditory stimuli.* As previously noted (p. 351), glaring and flickering lights induce displeasing reactions of blinking, closing the eyes, frowning, looking away, and other protective movements. Highly saturated blues and greens bring pleasing reactions. Harsh, rasping, shrill noises induce unpleasantness. The murmuring of wind in the trees, the rushing or trickling of water, the sounding of musical tones bring pleasing affective reactions.

5. *Affective reactions are evoked through the kinesthetic receptors* located in muscles, tendons, and joints. For a rested organism, rhythmical movements are usually pleasure-producing, whether they are made in work such as hoeing a field, in gymnastic exercises and sports such as rowing a boat, in dancing, or games. The free, untrammeled movement of the muscular system is pleasure-evoking. On the other hand, overactivity which induces fatigue with a sense of tiredness and lassitude is productive of unpleasantness.

6. *Organic* states of hunger, thirst, nausea, and those present in various disease conditions, are productive of unpleasantness and behavior which, so far as possible, tends to remove the source of discomfort. On the other hand, states of well-being, health, readiness for activity, are accompanied by a pleasant mood.

7. *Environmental* conditions such as temperature of surrounding air, humidity, air movement, and other elements of weather and climate are productive of pleasantness or unpleasantness. Whatever tends to interfere with maintaining the normal body temperature of 98.6°F gives rise to negative behavior associated with discomfort.

The above examples of affective reaction show that there is no one-to-one relationship between positive behavior and pleasant feeling, and between negative behavior and unpleasantness. Many peripheral manifestations of pleasant and unpleasant feeling—such as vocalization, change in sweat secretion, erection of hairs, trembling,

and so on—cannot be interpreted as seeking and avoiding reactions. Again, the responses to kinesthetic and organic excitations, though definitely affective, are not outwardly observable as simple positive and negative reactions. Finally, the feelings evoked by organic states and environmental conditions are relatively stable moods rather than simple feelings of brief duration. In a word, the theory which identifies pleasantness with positive behavior and unpleasantness with negative is not sufficiently comprehensive to cover all the facts.

Our conception of affective reaction stresses the process-like nature of pleasantness and unpleasantness. These feelings do not reside in objects, nor are they properties of objects. They are ultimate experiences which appear at the time of certain reactions to objects and situations.

In common parlance objects, events, and situations are spoken of as pleasant or unpleasant. Thus one refers to a pleasant evening, a displeasing meal, a pleasing personality, as if pleasantness and unpleasantness were somehow actually attributes of those things. Our hypothesis is that the feelings are the subjective aspect of organic reactions. Pleasantness and unpleasantness are projected into the outer conscious world; they give objects the *meaning* of pleasant or unpleasant. When, to illustrate, one says that the cold wind of a dark, rainy day is unpleasant, one cannot argue that the unpleasantness actually resides in the environment. Rather, an affective reaction is induced by the cold, the wind, the rain; unpleasant feeling or mood is outwardly referred to the inducing conditions.

PLEASANT AND UNPLEASANT FEELING IN RELATION TO MUSCULAR ACTIVITY

A critical examination of psychological hedonism should include a consideration of the relation of pleasant and unpleasant feeling to muscular activity. A few experiments bearing upon this topic will next be described.

Unpleasantness in Relation to the Strength of Voluntary Movement. In 1905 Störring published a few observations upon the relation of unpleasant feeling to voluntary action. He used a dynamometer which recorded the maximal extent of finger flexion.

In every trial the subject was given a taste solution just before he exerted his maximal pull upon the dynamometer. The taste solutions ranged in unpleasantness from indifferent to very disagreeable. Störring found that at the trials when the subject reported the solution as unpleasant the dynamometer registered a stronger muscular contraction than when there was affective indifference. Furthermore, the more intense the unpleasantness, the greater was the strength of the pull. The subjects were instructed to assume different types of preparatory set, but in all cases unpleasant feeling was associated with increased strength.

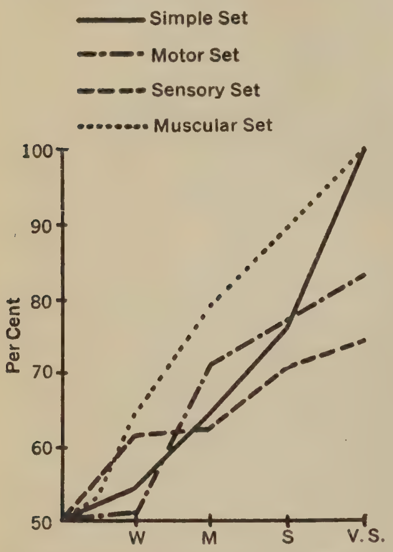

FIG. 77. RELATION OF MUSCULAR STRENGTH TO INTENSITY OF UNPLEASANTNESS. (*After Rose.*)

Ordinates give the percentage of pulls upon a dynamometer which indicate increased strength. Abscissae give the reported intensity of feeling—weak, medium, strong, very strong. The four curves are for different preparatory sets.

Later Rose repeated Störring's experiment with greater thoroughness. He obtained graphic records of the extent and duration of finger pull against the spring of a dynamometer, and also of the reaction time between a signal bell and the beginning of the movement. Unpleasantness was evoked by weak and concentrated taste solutions of salt, vinegar, and both mixed, which were given to the subject just before his pull on the apparatus. The intensity of disagreeable feeling was reported as weak, average, strong, very strong, and intermediate degrees. There were 2,493 trials distributed among six subjects.

Our interest centers in the comparison of muscular strength with and without a preliminary or a concomitant unpleasant experience. On the basis of graphic records and the subjects' reports, Rose concluded that sensory unpleasantness was associated with increased muscular strength, and further, that the more intense the unpleasantness the stronger was the pull on the dynamometer. The un-

pleasant tastes also brought about shorter reaction times than did the indifferent ones. The preparatory set of the subject had very little effect upon these results. Figure 77 shows one of Rose's graphs.

More recently Ernst has extended the work of Störring and Rose upon unpleasantness in relation to voluntary movement. His procedure was similar to that of Rose except that he used bitter taste solutions instead of salty and sour ones. Confirming the previous investigations, Ernst found that in the great majority of cases unpleasantness was associated with increased muscular strength and with shortened reaction time. The results of these experiments are definite enough, but unfortunately the work of all three lacked adequate controls.

Before interpreting the experiments of Störring, Rose, and Ernst it is important to consider other studies, using affectively unknown stimuli. In 1898 Cleghorn published a study which described the reinforcement of voluntary muscular contraction by simple sensory stimuli. He used a Mosso ergograph and asked the subjects to contract the finger muscles rhythmically once every three seconds to the stroke of a metronome.

Three kinds of stimuli were employed: (*a*) a light flashed into the eye, (*b*) a sudden sound heard through a stethoscope, (*c*) an induction shock applied to the skin. Graphic records of muscular contractions were obtained which also showed time and signal lines. Cleghorn found that a stimulus applied just as the muscle began a voluntary contraction brought increased height of the curve (strength of contraction). This result was announced at about the same time in an independent study by Hofbauer. Both investigators agreed that the augmentation was particularly noticeable as fatigue set in and the contractions were growing smaller.

In further tests, Cleghorn paid especial attention to the effect of stimulation introduced at the beginning of the relaxation phase. He found that relaxation was decidedly quicker and more complete when stimulation was introduced at the beginning of the relaxation phase than when no accessory stimuli were used. This was true with all three kinds of stimuli, as the following figures, taken from the study, show:

	No Stimulus		Stimulus at Beginning of Relaxation	
	Times of muscular		Times of muscular	
	contraction	relaxation	contraction	relaxation
Light......	0.51	0.61	0.49	0.29
Sound......	0.43	0.49	0.47	0.29
Shock......	0.38	0.51	0.44	0.33

The figures present the average duration in seconds of voluntary muscular contraction and relaxation with and without peripheral stimulation at the beginning of the relaxation phase. There is a decided shortening of the relaxation phase when stimulation occurs at the beginning of relaxation. After considering several possible hypotheses Cleghorn concluded that the accessory stimulation does accelerate relaxation, under these conditions.

The work of Cleghorn and that of Hofbauer indicate that sensory stimulation both strengthens the contraction and speeds up the relaxation of voluntary movement. Their work, however, is physiological and leaves us completely in the dark except for our own speculation concerning any pleasant or unpleasant feeling evoked by the three kinds of stimuli used. A final interpretation of the above group of experiments is not yet possible. The one point upon which they agree is that certain sensory stimuli facilitate voluntary muscular contraction when given just before or at the beginning of the contraction. Cleghorn and Hofbauer have shown that light, sound, and electrical stimuli facilitate both the contraction and the relaxation phases. Störring, Rose, and Ernst have shown that certain taste stimuli administered just prior to voluntary movement are associated with increased muscular strength and quickened reaction time.

This general result is important from the standpoint of motivation. Any stimulus which arouses a reaction is *ipso facto* a releaser of energy. A stimulus excites the receptor cells, and these in turn transmit the excitation to the neurons. The neural excitation travels and spreads until effector cells respond. The total physiological

process from stimulation to movement is one of energy transformation.

But how does unpleasant feeling come into the picture? It is evident that the work of Störring, Rose, and Ernst is ambiguous so far as any relationship between unpleasant feeling and muscular work is concerned. In the first place, their experiments were not controlled by the use of pleasant and indifferent taste solutions. In the second place, it is known that grief and other unpleasant moods temporarily decrease muscular vigor and strength, whereas a pleasant mood induced by good news is usually invigorating. Unpleasant anger, again, is energizing. Hence any generalization as to the relationship between affective experience and muscular strength must for the present be made with caution. In the third place, the physiological studies of Cleghorn and Hofbauer show that a variety of sensory stimuli modify muscular contraction. The nature of the stimuli was such that unpleasant feeling was probably evoked, but feelings were not reported in the experiment. Hence this physiological work remains ambiguous so far as the present problem is concerned. Undoubtedly there is a need for further research upon the relationship between muscular strength and affective processes.

For the present we tentatively accept the view that unpleasantness aroused by sensory stimulation is associated with increased muscular strength. This view fits in with other facts of motivational psychology. For example, the persistent stimulations from the tissues in hunger, thirst, extreme cold, and under other conditions have, among others, the following effects: (1) they determine unpleasant feeling, and (2) they release energy, thus raising the activity level. When the stimulations become intense the unpleasantness also grows more intense and the activity level rises markedly. These two effects—unpleasant feeling and energy release in the muscles—depend upon a common neural excitation. Thus they are associated but not causally related.

Pleasant and Unpleasant Feeling in Relation to Organic Responses. Investigators have studied the reports of pleasant and unpleasant feeling in relation to bodily processes, such as frequency and amplitude of pulse, frequency and depth of respiration, blood pressure, vasodilation and vasoconstriction (as shown by the volume

of the finger, arm, brain, or other part), electrical changes at the surface of the body ("psychogalvanic reflex"), etc.

These studies by the "method of expression" have revealed certain relationships. For example, unpleasant feeling occurs with quickened pulse and pleasant feeling with retarded pulse more frequently than the reverse. Unpleasantness is felt with decreased arm volume (vasoconstriction) and pleasantness with increased arm volume (vasodilation) more frequently than the reverse.

No one-to-one relationship, no perfect correlation, has been discovered. In view of this it is probable that pleasant and unpleasant feeling depend upon central nervous conditions which have a variety of peripheral manifestations, the outer pattern varying with inducing circumstances. One contemporary theory places the affective center in the thalamus, despite the prevailing view that conscious processes are determined entirely by the cerebrum.

The question of the peripheral changes associated with pleasant and unpleasant feeling was studied by the author in 1921, employing a method which depended entirely upon individual observation and report. A review of this follows.

Seven subjects, all psychologists, were given odors, taste-solutions, tactual stimulations, and a few chords or discords on tuning-forks. The presentations had been selected to evoke affective reactions. The instructions were:

> In this experiment be passive and receptive. Let the experimental situation have its full normal effect upon you.
>
> Report all muscular tendencies and organic sensations in any way related to the affective reaction.
>
> Report whether the experience was pleasant, unpleasant, or indifferent; and indicate the intensity of the feeling (using, for example, such terms as "very weak," "weak," "moderate," "strong," "very strong").

There were 340 reports, analysis of which brought to light the following relationships:

In 38 per cent of the reports of felt pleasantness or unpleasantness the subjects made no mention of muscular or organic sensations. The interpretation of this fact, however, is uncertain inasmuch as weak peripheral changes might have occurred which the subjects did not detect and report.

In the remaining 62 per cent unpleasant feeling, when reported, was associated with widespread bodily disturbances. Among the responses mentioned in reports of unpleasantness were: reflex withdrawal, thrusting the object away to prevent its action, inhibiting the reactions of swallowing, breathing or listening, reflex muscular twitchings and convulsive muscular contractions, frowning, snarling, starting, "moving waves of sensation," nausea, and various other bodily reverberations. The more intense the unpleasantness the more frequently were such bodily processes mentioned by the subjects.

In contrast to the above, the bodily reactions to pleasing stimuli were negative. Reflex responses were not mentioned, and bodily reverberations were absent. Felt pleasantness was characterized by accepting the situation and passively yielding to it. The characteristic organic response associated with pleasant feeling, so far as any could be found, was relaxation. In itself there is something negative about relaxation; it is the letting up of the strain which typically is associated with unpleasantness. In other words, unpleasant feeling appeared to be associated with tension-producing and pleasant feeling with tension-releasing processes. Apart from a few cases in which the subject actively sniffed or took a deeper breath to get more of a pleasant odor, there was no evidence of the traditional association between pleasing stimuli and seeking behavior.

On the strength of the results we questioned the validity of the hedonistic doctrine: that one seeks pleasing objects. Corwin then raised the objection that the conditions of the experiment were not favorable to active seeking movements in the case of pleasing reactions. He repeated the experiment under changed conditions, introducing moving stimuli such that the subject must follow in order to retain the smell of an agreeable odor or the sound of pleasing music delivered through a receding tube.

Corwin concluded: "There is no doubt that the most natural response to *U* is a movement of withdrawal. The direct response of the organism to *P* is, as stated above, either relaxation *with a certain degree of expansion*, if the stimulus is weak or stationary; or, if the stimulus is intense, and if the source of the *P* is withdrawn, a definite activity of pursuit or of tendencies to pursuit."

This again raised the question of the relation between pleasant

feeling and seeking behavior. Consequently we repeated Corwin's experiment with slight modifications in the conditions and found, in fact, that pleasantness was associated with movements towards the stimulus object and unpleasantness with movements away from it, more frequently than the reverse.

The picture was complicated, however, by the fact that affectively indifferent objects, such as a watch, drawn slowly away from the subject's ear, were also associated with seeking behavior. The "seeking" movements were slight adjustments of bodily posture to weak or receding stimulus objects. They indicate an attentive set for observation, and to interpret them as involuntary expressions of pleasant feeling is clearly a doubtful procedure. The traditional hedonistic doctrine is concerned not so much with simple approaches and avoidances as it is with complicated and prolonged pleasure-seeking purposive activities.

Pleasant and Unpleasant Feeling in Relation to Conflict of Responses. The neurologist, Herrick, has stated that normal activity of the body within physiological limits is intrinsically pleasurable, so far as it comes into consciousness, and so far as it is directed toward definite ends. Normal activities, he adds, are not satisfying unless they attain or at least approximate some particular end.

Herrick describes his neural theory as follows: "The normal discharge, then, of definitely elaborated nervous circuits resulting in free unrestrained activity is pleasurable, in so far as the reaction comes into consciousness at all (of course, a large proportion of such reactions are strictly reflex and have no conscious significance). Conversely, the impediment to such discharge, no matter what the occasion, results in a stasis in the nerve centers, the summation of stimuli and the development of a situation of unrelieved nervous tension which is unpleasant until the tension is relieved by the appropriate adaptive reaction. . . ."

In daily life severe mental conflicts are known to be unpleasant (see the cases on pp. 487-490), and relief from conflict is typically pleasant.

The writer made a preliminary experiment upon the relation between felt experience and the conflict of responses. In this work the subjects were seated on a table so that both feet could swing freely,

and a mechanical device was attached to the shoes to record the direction and extent of foot movements. In front of a subject were four small lamps arranged on a frame at the level of the eyes. Two of these lamps were on the right to signal for the *right* foot to move, and two were on the left to signal for the *left* foot to move. Two were remote from the subject to signal for *forward* movement and two were near by to signal for *backward* movement. The plan is shown in Fig. 78.

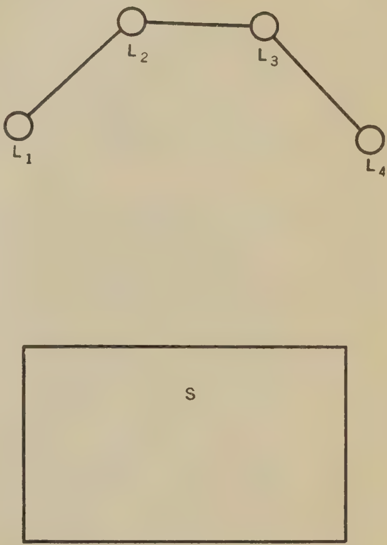

FIG. 78. APPARATUS USED TO STUDY CONFLICT OF RESPONSE. (*Young.*)

S gives the location of the subject. *L* 1 is the lamp to signal for backward movement of left foot; *L* 2 signals forward movement of left foot. *L* 3 is the signal to move the right foot forward; *L* 4, to move the right foot backward.

In an experiment the subject seated himself upon the table and awaited the signal lights. When a light flashed he moved his foot as mechanically as possible either in a forward or backward direction according to the signal. Every subject received ten trials per day for twelve experimental days, by which time the movements were quite automatic and machine-like.

The subjects were told that the experiment was concerned with the pleasant and unpleasant feelings associated with simple bodily movement, and from time to time during the habituation period they were asked to report whether pleasantness or unpleasantness was felt at the time of their foot and leg movements. To give a more complete affective setting the subjects were asked to report their affective reactions to odors both before and after the movement series.

After complete habituation, conflicting signals were introduced suddenly and without warning. *L* 1 and *L* 2 were flashed simultaneously and later *L* 3 and *L* 4 (see Fig. 78). This was done occasionally for two days and affective reports taken on all such trials.

The assumption of the experiment is that a conflict of impulses

to move should be unpleasant. With one subject and to some extent with another of the four, genuine conflict of response was induced and the report was of unpleasant feeling whereas the simple reactions had been reported as indifferent. With three of the subjects the conflict called forth smiling, laughter, and amusement which was characterized as pleasant. It was as if some joke had been played, a surprise given which was novel and amusing. The reaction in all cases was definitely affective when contrasted with the simple responses, but for three subjects it was a pleasant reaction instead of the expected unpleasant one.

The conflicting signals were repeated from time to time for a number of days. For a while there continued in some cases the inhibition, blocking, conflict, doubt, and strain, reported as unpleasant; and in others the smiling, laughter, and amusement which were reported as pleasant or indifferent. With habituation, however, these feelings disappeared and the double-light signal was finally taken as the signal for no movement. When the subjects had adjusted themselves to the new signal and looked upon it as the sign for no movement, the affective response to it was as indifferent as that to the accustomed one-light signals.

The foregoing experiment shows that an unexpected conflicting situation calls forth a definitely affective experience. Although we supposed that the experimental conflict of impulses would induce unpleasantness, we did not anticipate reports of pleasantness as well. The explanation of the unexpected result is this: The subjects doubtless took the experiment as a game, and the double signals as a slip on the experimenter's part, or perhaps as a practical joke. Hence there were amusement and smiling at the signal for conflicting movements. Again, in some instances it is likely that the pleasantness came from the release of the strain of conflict, this release conceivably occurring so quickly and automatically that it was not detected as a separate step or phase.

One other point should be borne in mind. The conflict in this experiment was induced by opposing simple habituated reactions. There was nothing vital at stake as with so many conflicts in real life. If the subjects' job, health, happiness, or something else of importance had depended upon making the correct response, the resulting pleasantness might not have appeared so quickly. Further

experiments upon conflicting determinations are needed, for the present study neither proves nor disproves the theory it was aimed to test. It does show, however, that the problem of conflict in relation to felt experience is much more complex than we at first assumed it to be.

THE MENTAL CONDITIONS OF PLEASANT AND UNPLEASANT FEELING

In discussing "mental conditions" the writer does not wish to imply that there are two kinds of ultimate reality—mental and physical. All that is meant by the term "mental conditions" is, conditions described from the standpoint of individual conscious experience.

The realization or thwarting of wishes, the receipt of good or bad news, the innumerable circumstances of life which affect our happiness or unhappiness, the events of our experience which make us laugh or weep, the countless annoyances and satisfactions of life—all of these conditions of pleasantness and unpleasantness are commonly described in terms of conscious experience. In the following pages some of these conditions of affective experience will be considered. Although the examples form an apparently disconnected series, they have one thing in common—they deal with pleasant and unpleasant experience in relation to conditions commonly called "mental" as distinct from those that are physical.

Fulfilment and Thwarting of Wishes in Relation to Pleasant and Unpleasant Feeling. The relationship of pleasantness and unpleasantness to wish fulfilment is illustrated by the following incident which occurred in the psychological laboratory at the University of Minnesota.

In making preparations for an experiment upon affective reactions it was necessary to select from the laboratory supply a small number of odors, some of which would be pleasant and others unpleasant to the subjects. I wanted to avoid indifferent smells and to find those evoking a distinct and intense affective reaction. I whiffed the odors one at a time more or less passively, and when one was found that displeased me I was immediately pleased—because it was *that* kind of an odor. With the very disagreeable odors there was an added element of amusement at the thought

that such an odor would be extremely unpleasant to the subjects of the experiment. The discovery of one or two pleasant perfumes also pleased me.

The experience was of a type which some would describe as a "mixed feeling": yet pleasing and displeasing affective experiences did not occur simultaneously. When I felt amused, the experience was wholly pleasant even though I was aware, at the time, of an odor which carried the meaning of "something unpleasant." It was an example of wish fulfilment and amusement evoking pleasant feeling despite the smelling of an odor which under other conditions would have aroused unpleasantness.

Conversely, it is common knowledge that the thwarting of one's wishes is typically unpleasant. This can readily be inferred from the behavior of children. For example, when Billie is all set to go to the circus and then prevented from carrying out his plan unpleasant feeling is clearly expressed.

A good illustration of the relation between felt experiences and wish fulfilment is found in the work of R. Katz. The following extended account is quoted from Beebe-Center's book, *The Psychology of Pleasantness and Unpleasantness.*

The best data on the relation of hedonic tone to wishes aroused under natural conditions are to be found, in my opinion, in R. Katz's study of loss of appetite in children. Around his fourth year, Julius, one of Mrs. Katz's children, began to refuse foodstuffs of all sorts, and consequently started to lose weight. Convinced from the results of a physical examination that the basis for this loss of appetite was primarily psychological, Mrs. Katz adopted the plan of letting the child order his own meals beforehand, impressing upon him that a meal which had been ordered must naturally be eaten. This procedure was completely successful. Whatever the child had ordered, he would eat without the slightest sign of loss of appetite. The first day, he ordered for his main meal potatoes, soup, meat, carrots, vanilla dessert with vanilla sauce. His meal was prepared accordingly, care being taken that the amounts of each food be not too large in order to facilitate the accomplishment of his undertaking. He ate everything without the slightest resistance. The next day he ordered the same meal over again, and again ate it without sign of lack of appetite. On the third day, he ordered the same meal except that vanilla sauce was changed to chocolate sauce, and he

ate the entire meal with apparent enjoyment. . . . On the fourth day he ordered meat, potatoes, carrots, semolina and ice cream with vanilla sauce—and again ate everything. And so, day after day, the ordered meal was consumed without any sign of rejection. Clearly these results suggest that by making the child order his own meal there was established in him a wish tending towards the eating of this meal, and that this wish manifested itself in making the child not only eat, but eat with relish the very same foodstuffs which previously he had rejected.

The same suggestion arises from the success of a slightly different procedure used by Mrs. Katz to overcome temporary losses of appetite. In certain cases her children would unexpectedly refuse to eat the meal being placed before them. Clearly the former procedure was of no avail; the problem required solution without delay. In such cases the children were told that they could prepare any dish they cared to from the foodstuffs on the table or from those in the kitchen, or eat these foodstuffs in any sequence that appealed to them. This procedure was entirely successful in that it made the children eat a meal with apparent relish, even though many of the combinations of foods and sequences of foods seemed to the father and mother to be anything but palatable. A few reports on such individual meals follow: "June 16, 1927, lunch. Chocolate and lard are cut up and put in a plate of bean soup. This is a mixture the very appearance of which is unpleasant to us adults, and which we would never have been able to eat. Julius, however, eats the mixture with the greatest relish and it agrees with him perfectly. . . . September 17, 1927, supper. Here it is the order of the foodstuffs which is particularly striking. 1. Meat and bread with butter; 2. bread with honey; 3. ice [ice cream?]; 4. honey eaten with a spoon directly from the plate; 5. meat eaten with the hand; 6. honey with a spoon; and 7. as a conclusion, meat eaten by hand. . . . October 4, 1927, supper. Potatoes, sauce made of fat and onions fried brown, and sugar, all mixed together in a plate and eaten with a spoon. This mixture is supposed to have been especially delicious." It is obvious that these data do not prove a specific relationship between hedonic tone and the wishes of every-day life. They do make it likely, however, that patient observation of children—or of adults, if they could be kept ignorant of the problem at issue—would show that the pleasantness of one and the same object or activity is as a rule greater when a wish has been aroused for it than otherwise.

Good and Bad News. Apart from the thwarting and fulfilment of wishes there are other mental conditions which call out felt experience. The news of the death of a loved one, the loss of money, disappointment in love, an insulting remark or slur which lowers self-esteem—these are a few of the conditions which evoke unhappiness. On the other hand, the receipt of good news, success in an undertaking, sudden acquisition of money, and unexpected professional recognition are some of the conditions which bring happiness. The feelings induced in these ways are often of the greatest intensity and of long duration.

An unusual combination of circumstances gave the Italian physiologist, Mosso, an opportunity to observe, in himself, the effect of good news upon muscular strength. His experience has been described by Beebe-Center as follows:

> In 1889, Mosso, then at the University of Turin, was training himself in the use of the ergograph. In the previous year he had been given a scholarship which had enabled him to work with Schmiedeberg at the University of Strassburg, but at the close of the year he had been obliged to return to Turin, and although he was very anxious to get back to Strassburg, could not see his way clear to do so. One morning, after completing around 9 A.M. a session at the ergograph in which, lifting a 5 kg. weight with his finger until he could no longer move the weight, he had made 14 lifting movements and produced work to the extent of 1.500 kilogrammeters—the usual amount for him—he was suddenly informed at 10 A.M. by his brother, a professor at the University of Turin, that he could return to Strassburg and Schmiedeberg. This news created in him a strong emotion. At 10.50, he carried out the second session of the day at the ergograph under the same conditions as earlier. This time he was able to make 21 lifting movements and to produce 2.555 kilogrammeters of work. He then went home to tell the good news to his parents and found there a letter informing him officially that he was to be sent to Strassburg. He writes feelingly: "It was a great joy that I experienced that day." At 12.50, having returned to the laboratory, he carried out a third session at the ergograph. This time he was able to make 30 finger movements and to produce 4.320 kilogrammeters of work. Mosso concluded as follows: "It follows from this experience, that a strong and agreeable emotion influences the activity of the muscles and makes them

develop twice and three times the normal energy. I did not continue the experiment because the state of mind in which I found myself did not allow me to busy myself longer with ergographic curves."

This result is of interest because it shows that one of the effects of good news and joy was to increase muscular strength. Contrariwise, there is some clinical evidence to show that sorrow is associated with a weakened condition of the muscles; that patients in a depressed mood are relatively weak, whereas those in a joyful mood are relatively strong.

Happiness and Unhappiness. The ethical hedonist regards the pursuit of happiness as the most important human quest. Certainly it matters a great deal to every one of us whether we are in a happy or an unhappy mood.

To study happiness and unhappiness Goodwin Watson prepared a self-rating scale and submitted it to 388 graduate students in education. The test contained six parts, briefly described as follows:

1. In the first part the subject was instructed to rate his own general happiness, comparing himself with other persons of the same age and sex. Five steps were specified on a line extending from "Among the most miserable of all" to "Among the happiest of all." In this part the subject was further instructed to indicate where his friends would probably rate him.

2. In the second part a series of descriptive phrases was presented and the subject requested to indicate which of the ten most nearly fitted himself. The first two of these descriptions are:

(*a*) Finding life rather disappointing and disillusioning, comfortable in many ways, moderately successful, but far from realizing the hopes of youth.

(*b*) Cheerful, gay spirits most of the time. Occasionally bothered by something but can usually laugh it off.

3. Part three required the subject to write in his own words a sentence or two descriptive of his general happiness in life.

4. In the fourth part a list of descriptive words and phrases was provided; the instruction was to check every term which applied to the subject. A few samples are:

_____Enthusiastic	_____Morbid	_____Disappointed
_____Distressed	_____Cheerful	_____Prosperous

5. The next part required the subject to rate his happiness in each of six areas of life. The rating in each case was done by placing a vertical line across a horizontal which indicated the extremes and average. These six areas are: health; vocation; love and marriage; friends; hobby interests; religion.

6. Finally, the subject was asked to rate his happiness or unhappiness at various stages of his life: early childhood; later childhood; high-school period; later adolescence.

In addition to the rating blank, every subject filled out an extensive questionnaire calling for detailed information on many points. The detailed results from the self-rating blanks and the questionnaire were analyzed thoroughly and summarized. Instead of going into the details of the analysis we will simply quote a series of hypotheses which were made by Watson on the basis of his study:

1. Intelligence has no relation to happiness.
2. Failure in love is a major cause of unhappiness.
3. Enjoyment of, and success in, work is a major factor in happiness.
4. Good health in childhood is the foundation for happiness.
5. Popularity matters.
6. School marks do not matter.
7. Success in dealing with people is fundamental to happiness.
8. Music and poetry tend to be refuges for the unhappy.
9. Religion, of the modern type, is not merely an escape for the unhappy.
10. Graduate students of education are, on the whole, fairly well satisfied with life.
11. General level of happiness among such adults can be measured with adequate reliability by a single check on one graphic scale.
12. The unhappy believe they give an impression of greater happiness than they feel.
13. Hobbies are not so important for life satisfaction as is sometimes supposed.
14. Youth is not the golden era of happiness; neither is age.
15. Only children are as likely, perhaps more likely, to be happy as are children in large families.
16. The comparative wealth of parents does not affect the happiness of children.

17. Educated parents do not raise happier children.
18. Quarrelsome parents, divorced, seem to hurt a child's happiness less than the same parents remaining together.
19. Mother careers do not make for unhappiness in children.
20. More or less knowledge of academic subject-matter does not influence happiness.
21. Participation in athletics is not significant for or against later happiness.
22. Parents over forty at the time of the child's birth are as likely as any to raise happy children.
23. Ability at dancing, cards, athletics, writing, music, or painting is unrelated to happiness.
24. "Radicals" are not the fundamentally unhappy.
25. A history of crushes does not necessarily indicate unhappiness.
26. A sex education, now regarded by educated adults as "wise," did not improve chances for happiness.
27. Those who look forward to living at age sixty, alone or with a sister, are predominantly unhappy.
28. The married are happier than the unmarried.
29. Men believe themselves happier than women believe themselves to be.
30. Success in dramatics is more indicative of happiness than is success in any other form of extra-curricular activity.
31. Blessed are those who are elected to many offices.
32. Love of nature goes with greater happiness.
33. The essentials of happiness for most people are among the stable elements of life (friends, work, nature) not among the stimulants (alcohol, clubs, churches, dancing, cards, automobiles, or arts).
34. Most people crave adventure rather than serenity.
35. Creative work with the hands is not fundamental to happiness.
36. Fears, sensitiveness, shyness, are rightly regarded as major factors in unhappiness.
37. Happiness is associated with serious, deliberate, responsible, earnest, hard-working living, rather than with impulsive, light, amusing, dilettanteism.
38. The proportion of error in these statements is uncertain, but considerable.

These hypotheses indicate the need for further research upon the conditions of happiness and unhappiness.

Under What Conditions Do We Laugh and Weep? Many theories have been proposed to account for laughing and weeping, but no one of them is wholly satisfactory. In the case of the funny story there is always (or should be!) some point, *i.e.,* an incident which induces a sudden disturbance of mental equilibrium. A well-told joke builds up a tension and then releases it suddenly in an unexpected manner. Even to the small child a sudden shift of conditions, as in the game of peek-a-boo, commonly evokes smiling or laughing.

Not every sudden shift of mental equilibrium, however, induces laughter. The shift must be a happy one rather than one which brings a sense of danger or defeat. To cause laughter, the point of a joke must elevate one's self-esteem, or give one a sense of belonging to the social group, or imaginatively gratify some wish, or suggest some other desirable result. Freud regards laughter as the release of a repressed complex; thus, in the sex-joke he states that it is the release of inhibition that causes laughter.

Weeping, on the other hand, results from wholly different mental conditions. Lund studied the situations which induce weeping. He analyzed the incidents occurring in motion-picture plays at the moments when people in the audience became lacrimose; he noted, too, the remarks made at funerals which induced tears. As a result he came to the view that weeping occurs when some redeeming feature in an otherwise bad situation is stressed, something happy or comforting in the face of trouble. When the minister, speaking of the one departed, says, "He was a wonderful father, a noble citizen, etc.," the tears begin to flow.

Lund's view makes it appear that weeping is an emotion of conflict or maladjustment. Anything which serves to accentuate the maladjustment or conflict, such as stressing the redeeming feature, may cause weeping or sobbing.

Mental Organization as a Condition of the Affective Judgment. In experiments, as well as in daily life, a person can estimate with moderate self-consistency the degree of pleasantness or unpleasantness evoked by a given stimulation. One way of demonstrating this is by the use of a scale of values.

In one of the author's experiments, thirty-two smell-substances were presented to subjects under controlled laboratory conditions.

The instructions, which are reproduced below, called not only for an immediate report of pleasantness or unpleasantness but also for an estimate of the degree, or intensity, of feeling evoked.

Instructions: "The experimenter will place beneath your nostrils a bottle of odorous substance. Take three deep breaths every time an odor is presented.

"Immediately and without reflection indicate how the experience felt. If your attitude was one of indifference, indicate by 0. If pleasure was experienced, indicate by +, and if displeasure was experienced, indicate by —. Study carefully the scale of values on the accompanying sheet so that you may give the degree of feeling by one of these numbers."

On a separate sheet the following scale of values was presented:

+5 very great pleasure
+4 great pleasure
+3 pleasure
+2 slight pleasure
+1 very slight pleasure
0 indifference
—1 very slight displeasure
—2 slight displeasure
—3 displeasure
—4 great displeasure
—5 very great displeasure

The results for seventeen adult subjects (several more for some of the odors) showed a considerable degree of consistency in making affective judgments. The subjects all agreed in reporting certain of the odors wholly on the negative (unpleasant) side and certain others wholly on the positive (pleasant) side of the scale; but most of the odors were placed in between, with some positive and some negative judgments. This appears in the table of distributions of judgments for eight typical stimuli on p. 374.

The table presents the most pleasant and the most unpleasant odor; every one of the thirty-two odors was located somewhere within this series of judgment distributions. Incidentally, some odors give a wide range of judgments over the scale of values; others are more narrowly restricted. In this respect compare *phenyl ethyl alcohol* and the *empty bottle* which was used as a control.

Stimuli	Frequency of Judgment for Points on the Scale of Values										
	−5	−4	−3	−2	−1	0	+1	+2	+3	+4	+5
Di-*n*-butyl amine.......	5	5	5	2	1						
n-Heptoic acid.........	2	2	7	4	3	1					
p-Cymene..............		4	3	2	3	4	1				
Phenyl ethyl alcohol....		1	2	2	4	2	2	2	3	1	
Empty bottle..........				1	2	12	3				
Camphor..............					3	1	5	6	4		
Geraniol...............					2	1	7	3	4	2	
Eugenol...............						1	5	5	4	2	2

In order to determine the constancy of these judgments for the individual from day to day, the entire series was presented to two subjects for twelve successive experimental days. The conditions were the same as in the above experiment except that a different haphazard order of presentation was used every day. Two typical odors and the control (empty bottle) have been selected to illustrate the extent of variability in affective judgment. It will be noted that the judgments of an individual are restricted to a given region of the scale of values.

	Stimulus	Judgments on Successive Days											
		1	2	3	4	5	6	7	8	9	10	11	12
First subject	Acetophenone	−1	−3	−2	−3	−3	−3	−3	−4	−2	−3	−3	−3
	Coumarin	0	+1	+1	+1	+1	+1	+1	+3	+3	0	+2	+3
	Empty bottle	−2	0	0	−2	0	0	−2	−1	0	0	−1	0
Second subject	Methyl salicylate	+4	+5	+5	+4	+4	+3	+4	+4	+2	+5	+5	+5
	n-Caproic acid	−3	−4	−5	−4	−4	−5	−4	−4	−5	−3	−5	−3
	Empty bottle	0	0	0	−3	0	0	0	0	−1	0	0	0

These results indicate that a presentation is judged quite consistently pleasant, unpleasant, or indifferent when it is presented repeatedly to the same subject. Inasmuch as the sequence of odors was changed from day to day it is probable that some of the variations in degree of pleasantness and unpleasantness shown in the judg-

ments were dependent upon the contrasts between successive affective experiences (pp. 335-337).

An important source of variation, however, lies in the scale-of-values method itself. This procedure requires the subject to apprehend the scale as a whole at the same time that he is estimating intensities of all affective experiences. This is a complex process. Partially obscuring the physiological conditions which determine the kind and degree of affective reaction are the psychological conditions which determine judgment.

When a balanced scale of values is employed certain of its distinctive points stand out in the mind of the subject and these are used more frequently than are the intermediate points. This fact is well brought out in a study of the scale-of-values method by Conklin, in which a group of 1,699 school children were asked to judge the pleasantness or unpleasantness of a variety of actions; such as: "to do ridiculous initiation stunts in public," "to stand by some principle you believe in, even though everybody laughs at you."

Conklin used a value scale of thirteen points. In looking over the results one is impressed immediately by the relatively high frequency with which judgments were placed at certain distinguishing points on the scale, especially at numbers 1, 4, 7, 10, and 13. The following gives the total frequencies of judgments for the various scale points:

1	Greatest possible pleasure	565
2	Very, very great pleasure	359
3	Very great pleasure	530
4	Great pleasure	1,025
5	More than a little pleasure	633
6	Just the slightest pleasure	785
7	Neutral, neither	1,196
8	Just the slightest displeasure	851
9	More than a little displeasure	779
10	Great displeasure	1,232
11	Very great displeasure	581
12	Very, very great displeasure	479
13	Greatest possible displeasure	1,179

This decided (though usually unconscious) predilection for certain points on the scale of values reminds one of Coover's well-

known study in which preferences for round numbers were clearly demonstrated. He found, for example, that, in the twelfth and thirteenth United States census reports, the figures indicate that persons give their ages most frequently in multiples of five and ten years. He also brought out the fact that when students' grades are awarded on a percentile basis the teachers exhibit the same prejudice in favor of multiples of five and ten. Further, Coover found that judges in determining criminal sentences have a distinct preference for round numbers when the sentence is in years, and for quarters of a year when the sentence is in months. Again, in estimations of the magnitude of stars, a bias in favor of round numbers is manifest; one bit of evidence gives 1,239 stars of the 6.5th magnitude and only 159 of the 6.6th. Similar number preferences in guessing and in other uses of figures can readily be demonstrated.

There is no doubt that this predilection for certain points on a balanced scale is one factor which complicates the results of all experiments relying upon the scale-of-values method. A judgment of affective intensity depends, to be sure, upon the affective reaction itself, but it depends, too, upon one's understanding and grasp of the scale, upon whatever preference one may have for certain points on the scale, and probably upon other factors.

Annoyances. No study of the mental conditions of pleasant and unpleasant feeling would be complete without reference to Cason's interesting study of annoyances. The method in this thorough investigation was simply to collect and tabulate the objects, events, and situations recalled by the subjects as having been annoying.

Cason collected 21,000 specimens of annoyances (including duplicate examples) from 659 subjects representing practically all ages, and all degrees of intelligence, wealth, social position, physical characteristics, and other qualifications. Sample annoyances taken at random from the collection by Cason are:

A person in an automobile I am driving telling me how to drive.
To hear a person chewing gum loudly.
To see a person's nose running.
A person coughing in my face.
A person telling me to do something when I am just about to do it.

A person crowding in front of me instead of waiting his turn when I am waiting in line.

A person bragging about himself.

A person continually talking about his illnesses.

To see an intoxicated man.

An effeminate man.

To hear a person sucking his teeth.

To hear a person reading the titles aloud during a moving-picture performance.

To be pushed when in a crowd.

A person looking over my shoulder and reading the book or newspaper I am reading.

A person hinting at a sex subject and using words and expressions that have a double meaning.

To hear a grown person talk baby talk.

A person in conversation with me not paying attention to what I am saying.

To see or hear an animal being cruelly treated by a person.

To have to wait for a person who is late for an engagement.

A person continually complaining about something.

Mice.

To hear the continual blowing of an automobile horn.

To find some dirt in the food that I am eating.

To see lack of neatness in dress.

The odor of a bad breath.

To see excessive cosmetics on a woman.

To see food on a person's face near his mouth.

The odorous condition of another person's body.

The annoyances for the total group were carefully classified and tabulated. Cason writes: "57% of all of the annoyances, including duplicates, were concerned with human behavior, 16% with non-human things and activities (exclusive of clothes), 12% with clothes and manner of dress, 10% with alterable physical characteristics of people, and 5% with persisting physical characteristics of people. People are mainly annoyed by the behavior of other people. Clothes are more important in this respect than the alterable physical characteristics of people. It is also significant that 28% of the annoyances are concerned with non-human things and activities, whereas only 5% have to do with persisting physical characteristics of people."

Of course there are numerous and marked individual differences as to what was reported as annoying.

Cason's study stresses the importance of social factors—behavior of others, clothes and dress of others, characteristics of people—in determining annoyances.

PREFERENTIAL DISCRIMINATIONS

Positive and negative reactions are made to a single object, a single situation, or to one aspect of the world at a time. Preference in its simplest form implies an active discrimination between at least two items, along with acceptance of one and rejection of the other. When a rat is given opportunity to express preference between two foods he may, for a long series of trials, accept the first food that chance brings under his nose with little or no regard for its quality, failing completely to make any preferential discrimination. Gradually, with repeated discriminations, the same animal comes to show a clear and consistent preference for one of these foods. The rat cannot be forced to discriminate preferentially by any method known to the writer; sometimes he does and sometimes he does not express a preference between two foods (pp. 109-113).

In animal work the basic fact of preference means that *A* is taken instead of *B*, or before *B*, with great consistency and regularity. A single test is not enough to reveal preferential discrimination; a whole series of trials is necessary.

In studying preference with animals the experimenter must base his work upon the fundamental drives, such as hunger, thirst, sexual urge. The presentation of geometrical forms, colors, tones, and other biologically indifferent material does not lead an animal to make preferential discriminations, unless such materials be used to symbolize biologically important goals, such as food or water. With symbolic rewards discrimination may be learned; but in this case the preference is between the goals symbolized rather than the symbols themselves. The latter serve only as cues to reaction.

In human experiments upon preference the subject is given verbal instructions; he is asked, for example, "Which of these two musical chords do you prefer?" or "Which of these pictures do you like better?" The instruction in the laboratory situation gives the subject a determination, a set; he attempts to discriminate and to express

a preference. Of the various methods which have been employed in preference tests with man, the more important are here described:

1. *The method of paired comparisons.* With this method two colors, forms, tones, musical chords, odors, photographs, or other materials are presented to the subject simultaneously or in immediate succession for a preferential judgment. The instructions to the subject and the technique of presenting materials are, of course, carefully controlled. The subject's task is merely to indicate which of the pair is preferred. The experimental series is so planned that each member is compared with every other member. In computing results the number of preferences for every unit of the series is determined, the judgment "equal" being counted as ½ of a preference for each unit of the pair. A curve of relative preference may be plotted from the data, for study.
2. *The scale-of-values method.* The subject is given a prearranged scale of affective values ranging from very pleasant through indifferent to very unpleasant. Materials such as those listed above in method 1 are presented one at a time for judgment, and the subject is instructed to evaluate them by reference to the categories of the scale. The method was discussed in the foregoing section upon mental organization as a condition of the affective judgment (p. 372f.).
3. *The order-of-merit method.* The materials for preferential judgment are spread out on a table or presented successively. The subject's task is to rank them in order from the most preferred to the least liked.
4. *The method of choice.* With this method a group of materials are presented collectively, the subject being instructed to select the one most preferred. From the materials remaining after the first choice he is asked again to select the most preferred, and so on.

Each of these methods gives an order of relative preference for the materials presented. It is well to be acquainted with the preference methods, not only because of their usefulness in psychological research but also because they are of practical value in everyday life, *e.g.,* in selecting the most preferred photographic proof, in judging the entries in a contest, in evaluating advertisements or almost any material, in choosing a name for the baby. If properly understood and used, these methods are distinctly superior to the desultory means of determining preference commonly employed in daily life.

Preferential Discrimination and Affective Reaction. From the standpoint of the history of psychology one of the main sources of confusion within affective psychology has been the failure of psychologists to discriminate clearly between the problems of preferential discrimination, on the one hand, and the problems of felt experience, on the other. The preference methods have been placed in the textbooks in the context of affective psychology, despite the fact that they are wholly ambiguous regarding the existence and nature of the subject's felt experience at the time he makes a preferential discrimination. One cannot assume that the preferred of two objects necessarily brings a pleasant affective reaction, nor that the unpreferred object evokes unpleasantness—at the time the preferential discrimination is being made or under other circumstances. In studies with animals the question of whether a rat feels pleased when making a preferential discrimination does not arise; it can well be left to the metaphysician.

The result of every preferential discrimination is determined by opposed motivating factors. It is a process of choice. There is no denying the fact that with certain simple and strongly affective presentations, such as two odors or two cutaneous stimulations, the affective reactions often do play the deciding rôle in the choice. A preference may be expressed immediately: "*A* is pleasing, *B* is displeasing, I prefer *A*," or "*C* is less displeasing than *D*, I prefer *C*." In these and similar cases the affective reactions may be so distinct and intense that a preference is revealed without delay. The subject is more or less passive; one or more affective reactions have their way with him and determine preference. But, as noted above, one cannot argue conversely that a preferential discrimination is evidence of felt pleasantness or unpleasantness. With weakly affective presentations the preferences do not arise spontaneously; a choice has to be actively made. The person making the choice considers the alternatives and deliberates—"This aspect is favorable and that unfavorable; this is liked, that disliked." Finally a decision is made—*A* is preferred to *B*. The processes of deliberation and choice-making are especially well marked in such complex tasks as deciding the relative merits of works of art, evaluating personalities, choosing a place to go for the summer vacation. The making of that sort of deliberate choice is far removed from those simple preferential discriminations

which are, in fact, closely associated with affective reactions, but there are all gradations from the preferential discriminations which are determined by the immediate affective reactions to those which involve prolonged and elaborate deliberation. It is difficult to draw a hard and fast line of demarkation.

Changes in Preference with Age. Some likes and dislikes are relatively stable apart from the age and experience of the subject (pp. 345-348). Others are especially likely to change with growth, education, or contact with propaganda. One's likes and dislikes for architectural styles, musical forms, costume designs, paintings, and statues are especially subject to modification with training.

Writing about color preference in relation to age, Beebe-Center, after a review of the extensive literature on the subject, summarizes it as follows: "In the first half-year, preference depends only upon saturation and brilliance: chromatic colors are preferred to greys, but between different chromatic colors preference is a matter of brilliance, not of hue (the more brilliant being preferred). In the second half-year, hue becomes a factor in color-preference, the warm colors (red, yellow and orange) being preferred to the cold ones (blue and green). From the third to the fifteenth year, preference for warm colors over cold ones gradually disappears, so that by adolescence either cold colors are actually preferred to warm ones, or the distinction between warm and cold colors ceases to be a factor in preference."

The preference for musical intervals also changes with age. Young children like the minor second and the major seventh, whereas adults generally dislike these intervals. Beebe-Center has suggested that children probably compare musical discords with all the sounds in their recent experience, including the most unpleasant noises, so that all musical tones are relatively the more pleasant; whereas adults and musically gifted children compare musical intervals with discords, and since the discords are the least pleasant they tend to be judged absolutely as unpleasant. As early as the sixth or seventh year the child's preferential order for musical intervals is similar to that for adults. The similarity is more marked with musically trained children than with those who are musically untrained. An interesting sidelight on the topic is furnished by the history of

music, which records very gradual developments towards the preferential use of certain intervals, such as thirds and seconds. This fact indicates that training and convention play their parts in the determining of relative preference for certain musical intervals.

THE RELATION OF PLEASANT AND UNPLEASANT FEELING TO MOTIVATION: FACTUAL HEDONISM

At the start of this chapter we discussed the traditional doctrine of psychological hedonism, which has long been considered as a general theory of motivation. Our reasons for rejecting hedonistic explanations of behavior may be stated briefly as follows.

In the first place, any theory which limits the behavioral counterpart of pleasant and unpleasant feeling to movements of pursuit and avoidance is too narrow. These feelings are associated not only with positive and negative behavior but also with a host of other expressive movements, such as vocal outcries, vasomotor changes, random movements, changes in glandular secretion, erection of the hairs, muscular strain or relaxation. When all the peripheral manifestations of feeling are examined no single instance of perfect correlation is found to exist between affective experience and bodily expression. Pleasantness is just as likely to be expressed by relaxation as it is by active pursuit; unpleasantness may be indicated by uncoördinated random movements as well as by active avoidance.

A second difficulty with the hedonistic doctrine lies in the teleological nature of the conceptions of seeking and avoiding. Many times there is no difficulty in distinguishing seeking from avoiding, but sometimes both interpretations are possible. The man *avoids* the bear in the woods to *seek* a safe spot. The drowning rat is *seeking* the air and *avoiding* the water. In such cases the individual may or may not be clearly aware of his goal, but when viewed objectively one cannot be sure of the end.

A third difficulty with the hedonistic theory is that *seeking* behavior is most typically associated with unpleasantness. A hungry man seeks food; a desperately poor worker seeks money; a submerged diver seeks the air. In all such examples the motivating factor is the source of unpleasantness. Some irritant, need, goal set, or drive stimulus motivates behavior. Typically the motivating factor in *seeking* behavior is not the pursuit of pleasant feeling. In fact, it has been pointed out as a hedonistic paradox that the pursuit

of pleasant feeling *as such* fails to produce pleasantness. Pleasantness is generally a by-product of activity.

When a mother rushes into the burning house to rescue her child it is hardly the pursuit of happiness and the avoidance of unhappiness which motivates her. Her nervous structure as modified by past experience has given a determination which, in the excitement of the situation, forces her into the fire. Considerations of pleasantness and unpleasantness scarcely enter the picture at the moment.

Factual Hedonism. In the latter half of the present chapter we described some experiments which bear upon the problem of pleasant and unpleasant feeling in relation to motivation. Throughout this discussion we held to a factual, or process, point of view. That is to say, we considered pleasantness and unpleasantness as conscious processes existing within individual experience. We examined their relation to stimulating objects, to muscular activity, to mental conditions, and finally to preferential discriminations. In no case did we regard pleasant and unpleasant feeling as a *causal* factor in behavior.

One group of experiments revealed that pleasantness *as a fact* is more frequently associated with seeking or maintaining behavior than with avoidance, and that unpleasantness is very often associated with escape and avoiding reactions. This experimental result confirms the common hedonistic theory. In daily life we do, in fact, seek to establish or retain those conditions which favor pleasant feeling. We lean forward to get another whiff of the fragrant rose; we go to the movie just for fun; we walk for pleasure to the park where there are green trees and spraying fountains. We also avoid any unpleasant or annoying object.

We can admit that in general unpleasantness is associated with avoidance and pleasantness with pursuit *as a fact* without accepting psychological hedonism as a motivational *theory*. This factual, empirical envisagement of hedonism we will call *factual hedonism*. Factual hedonism implies no theory as to the determination of conduct, but is only the assertion of the demonstrable fact that unpleasantness is associated with avoidance whereas pleasantness is associated with the attainment of a goal.

On the side of interpretation we regard pleasantness and unpleasantness as individual experiences which reflect the dynamic interplay

of motivating processes. When there is conflict unpleasantness is felt, and when there is release of conflict or a solution of some difficulty pleasantness appears. If a wish is thwarted, there is unpleasantness; if realized, pleasantness. If good news is received, *i.e.,* news satisfying some desire, there is pleasantness; if bad news, unpleasantness. Whatever injures the tissues, or increases mental tension, or leads to failure and maladjustment, induces unpleasantness. Whatever satisfies a tissue need, releases tension, brings success and adjustment, evokes pleasantness. Pleasantness and unpleasantness are thus the manifestations within conscious experience of the dynamic interplay of motivating factors. They are the subjective signs of conflict, release, overstimulation, and other conditions existing within the physical mind.*

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CHAPTER VIII

SOCIAL MOTIVATION

> "The importance of sound knowledge as to how the motivation of an individual may be controlled by his social environment cannot be exaggerated. It is the problem of problems for psychology as applied to many practical fields of human endeavor."
>
> —John Frederick Dashiell

From birth until death the individual is to a high degree dependent upon his fellows, not only for food, shelter, and the very name he bears, but also for his standards of conduct, attitudes, sentiments, interests, and the traits of his personality. Although this is most completely true when he is very young, still at every age of his life, his social environment plays an important part in determining his behavior. Take, for example, the college student. He belongs to several groups—first of all to his family; then perhaps to his church group, his fraternity or club, other social or professional organizations, and his political party; he belongs also to a large group of casual acquaintances and associates, and, closest of all during his college years, to the circle of his intimate friends. There is a handful of his teachers, too, who help to shape his patterns of thought and action. If he were suddenly transplanted from these social groups to a set of wholly different ones, his behavior patterns would become radically changed, for a person's idea of himself, all that he does and thinks, his individuality, are in large part derived from the rôle he plays upon the social stage. Of course this rôle is derived not only from the present social evironment but also from the whole sequence of previous ones.

In the foregoing chapters the biological factors in motivation, especially those fundamental ones which are based upon persistent organic conditions, have been considered in detail. Some of the social factors playing a vital part in the determination of conduct will now be examined—the desire for prestige, the presence of a co-working

group, rivalry and competition, praise and reproof, suggestion, belief, and other factors.

PRESTIGE MOTIVATION

The normal human individual seeks in some sphere or other, by this method or that, to assure himself of his superiority over other human beings. He craves recognition, distinction, success, power, leadership, wealth, influence. He wants to be *on top* instead of being the under dog; *inside* the group he considers to be the best one, rather than on the fringe. In every walk of life there are struggles going on for standing in one's group, *i.e.,* for prestige.

In the army, for example, there is a carefully developed system of ranks and titles for commissioned officers. Important title, great power, and high prestige belong together. In a university faculty the system of ranks and titles is the same in principle. The president, deans and directors, heads of departments, and other executives have in general more prestige than other faculty men. These executives have the authority to give men their positions and to take them away, they pass upon the merits of men in making promotions, they recommend men for positions in other universities. In a word, they have power over the destinies of men; this power carries prestige with it. Again, the faculty man who holds no executive office may still be a leader in his special field. He may have a kind of prestige which depends upon recognition of merit by his professional group.

Among married women social standing is in good part determined by the prestige of their husbands. A woman is certainly honored for her own talents, charm, and achievements, yet it must be admitted that, other things being equal, the wife of a successful and powerful business executive will stand higher in the social scale than the wife of a good man whose main virtue is an humble and a contrite heart. Mrs. Pettyman, for instance, kotows and toadies when Mrs. Hightower, the wife of the general manager, enters the room.

Nothing is more irritating to a person, no matter what his social status, than being classed as common. The words, "Nobody notices me; I'm just like the rest of ordinary folks," express the feeling of inferiority which arises when one regards himself as wholly lacking prestige. The scientist who is awarded the Nobel prize, the salesman

chosen to receive the firm's national prize for salesmanship, the common laborer who is appointed boss of his gang, each is pleased by the recognition which lifts him above his ordinary human herd. The woman who is told that she is beautiful is made happy by the compliment partly because she knows that beauty gives her distinction in the sphere of feminine charm and appeal.

The desire for prestige often finds expression in a play for attention and notice. If there is a choice between being ignored and being reproved, the reproof is usually regarded as the lesser evil. Even the asking of a small favor is in a sense a social recognition, and may be regarded as a pleasing notice, especially if the person asking it is one looked up to or admired. A way to win someone's good will is to ask of him a favor, the granting of which confers upon him a special distinction, or gives him an opportunity to display his particular talent or ability.

Often a person risks his life to gain notice, perhaps even to see his name in the paper. According to reports of the Loeb-Leopold trial one motive for the murder was to get public notice and attention. That, of course, was an extreme case; but it is common knowledge that most people are pleased to see their names in the paper or to hear them mentioned in a radio broadcast. Sometimes, in more reticent circles, one may gain an even greater prestige by refusing to allow his name to appear in the paper, or by concealing his name as the donor of a gift.

Although prestige motivation is basic to social behavior it must not be overstressed to the exclusion of other important motivations. The man of science working tirelessly to find new truths, the mother concerned for the welfare of her little children, the social worker interested in the health and happiness of others, the artist living for his work—these illustrate behavior patterns in which motivations other than prestige are present.

Physique and Leadership. A man's likelihood of holding an important executive position is definitely related to his physical build, particularly to his height, weight, and appearance of vigor. Gowin has shown that executives in general are taller and heavier than men not in executive positions. Taken as groups, superintendents, wardens, chiefs of police, railroad presidents, reformers, bank presidents, governors, senators, chiefs of fire departments, are men

of large physique—taller and heavier than the average. Moreover, the executives in important positions were found on the average to be more imposing physically than those in less responsible positions. Bishops were found to be taller and heavier than small-town preachers, presidents of universities than those of small colleges, city school superintendents than the principals in small towns, presidents of the state bar than country attorneys, sales managers than salesmen, railroad presidents than station agents. These averages do not prove, of course, that a man of small physique cannot become an executive. They do mean that, in general, physical size is one measurable factor favoring leadership in the various activities.

The man who is physically outstanding presents the appearance of having strength, vigor, force, power, which is all in his favor when it comes to dominating a social situation. Let us imagine two men making the same address before the same audience. One weighs two hundred pounds, is six feet tall, and has a bass voice; the other weighs one hundred and twenty pounds, is five feet four inches in height, and has a rather high-pitched voice. The big man talks slowly and ponderously; the little man rapidly and nervously. Which physique will impress the audience more favorably? Which appearance will carry more conviction? History tells us that the little man, by superior intelligence, skill, and wisdom, by persuasive personality, by the intensity of his drive combined with fortunate circumstances may be carried to a position of far greater power and prestige than the big man who has a lesser degree of these qualities. But the fact remains that the large impressive-appearing man has the advantage of physical prestige to help him advance.

The monarch or dictator, upon whom prestige is bestowed by the national group, is expected by all to act the part of a national hero. He must appear in a high silk hat or in one with a plume upon it (which increases his height and impressiveness), his wife must wear an elegant and distinctive gown and act her part as a great and gracious lady. His house or palace must be beautiful and impressive, a symbol of wealth, power, and prestige.

Physique and the Attitude of Inferiority. The Viennese psychiatrist and psychoanalyst, Alfred Adler, has explained traits of behavior in terms of defeated or thwarted prestige motives. He pointed out that neurotic patients suffer from feelings or convictions

of their own inferiority. Usually they have some bodily defect such as poor eyesight, deafness, weak lungs, heart, or other organ, or they are deformed—handicapped socially in one way or another. During childhood the physical defect forced the individual to realize that he could not compete successfully with normal playmates. He was the loser in games, the target of ridicule, and as likely as not he acquired a nickname inspired by his deformity or handicap. As a result he developed attitudes of jealousy, suspicion, fear, and inferiority.

Any peculiarity which marks one out as different from the herd in an unfavorable way is the source of unpleasantness, and of an urge to compensate for this defect. If one is fatter than the average, one seeks to be thin; if thinner, one seeks to gain weight. If one suffers from some obvious impairment, one tries to conceal it or to make good in spite of it. This is especially apparent in the case of speech defects, dental deformities, birthmarks on the face, cleft palate, hare-lip, crippled limbs, and similar disfigurements.

The following case, described by Bagby, illustrates the defense reactions of a college student to his unsightly ears:

This young college student has been reared with a pain-punishment technique with the result that a typical conditioned-fear pattern had been established. That is, he reacted with fear to any stimulus suggesting criticism. Reaching college with this mechanism thoroughly formed, he reacted with a mild fear to the humorous comments passed upon his mule-like ears. The first of the trials of the trial-and-error which he exhibited in securing a reduction device consisted in letting his hair grow to such a length that his ears were completely concealed. This, however, did not bring about reduction, since his long hair was a new source of comment and unfavorable attitude. Shortly afterwards, he displayed a new trial which involved an effort to limit his social contacts to persons who were sympathetic. This was equally unsuccessful because contact with critics proved to be inevitable in the course of his undergraduate life. Finally, chance supplied him with a reductive process which persisted for many years. He happened to be talking to a small group of men on one occasion when he heard the sound of distant music. Upon inquiry, he discovered that no other person present had heard what he had. Immediately, he had a thought which quickly became a permanent part of his "ear" complex. "I have a fine ear for music

and these persons who are amused at me are fools. They do not understand that the form of my ears gives me a fine sense for small tone differences." It is very noteworthy that the young man began immediately to undertake the serious study of music and actually has become an excellent teacher of singing. For present purposes it is interesting to point out that, through a process of trial-and-error, the patient secured a reductive process of thinking which operates to destroy "the stimulating value" of criticisms directed at his personal appearance.

Compensations for Intellectual and Social Inferiority. Quite apart from outwardly apparent physical defects, a sense of inferiority may grow out of failure in any sphere of life—intellectual, economic, moral, esthetic, political, etc. There are plenty of men in the world with fine physiques who have accomplished little or nothing to distinguish themselves from the herd. Possibly they are handicapped by a low degree of intelligence, by poverty, by unfortunate home training, or by the unenlightened dominance of well-meaning parents. There are all sorts of circumstances which handicap one.

During his entire lifetime an individual may be motivated by an urge to demonstrate superiority in the face of some social or intellectual obstacle. The possession of low intelligence is one of the main factors in the failure to achieve distinction. Plenty of individuals with physical vigor have accomplished little or nothing to distinguish themselves, mainly because of their intellectual limitations. The dull student seeks by hard work, by alibis, by substitution of extra-curricular activities, and by other means to hide his obtuseness. In the economic sphere, poverty may be compensated for by honest and industrious activity, by striving for wealth, by taking infinite pains to keep up a good front, by complaining about hard times, or by talking about rich relatives. The shrewd business man, by contrast, who has made a fortune through squeezing money out of others, compensates for a sense of moral guilt by contributing to churches and to other worthy institutions. His self-evident generosity and virtue obscure the questionable methods by which the money was raised.

The child may compensate for a sense of inadequacy by imposing upon his playmates, the members of his family, and others in a great variety of ways. He may get his way by whining, by temper

tantrums, by sulking and refusing to play. Possibly he becomes a bully toward smaller children when at heart he is a coward and weakling.

As Watson once put it, ". . . one man constantly makes a poor score in golf, but he prides himself on having better 'form' than any other member belonging to the club. Money suddenly acquired is often a balancing or compensating factor for lack of breeding and social position. A woman lacking beauty of face preens herself over her form, or lacking both, upon her hair, or even upon the size of her feet or the shape of her hand. Lack of special recognition and position of a given family is compensated for by the fact that they are relatives of some person of recognized ability and attainment."

The Basis of Prestige Motivation. In all the above examples of prestige motivation the fundamental factor is the *level of one's self-esteem.* In the constant interaction of self with others the belief is gradually built up that one is more or less competent, better or worse than others. This level of self-evaluation, which depends largely upon what others say and do, is the basic fact underlying prestige motivation.

Prestige means power, recognition, social security, the high esteem of others. The person upon whom prestige is bestowed by the group is in a position to lead. Not only can he command the services and financial resources of others, but also he has a strong position in the struggle for the goods of this world. For one thing, the man who excels can gain a bigger money income than his competitors in almost every walk of life. Under our present economic system money brings the power to satisfy wants; money is a recognized mark of success. The wealthy man is able to support his family in comfort, he can travel, enjoy recreation, satisfy his whims. The rich dowager whose only assets are financial ones stands well in the community. Her economic prestige gives her a halo, such that her ideas about literature, politics, philosophy, religion, or what not, are listened to respectfully, and sometimes published in the papers.

In every sphere of life prestige is equivalent to success. Economic prestige is success so far as wealth is concerned. In the realm of friendship and love the person who can win and hold the affection of others has an enviable position. In the business or profes-

sional world, on the golf course, in the class room, in the parlor—some individuals are outstanding; they are the ones recognized as successful.

In most cases the biological utility of prestige is quite apparent. Social standing enables one to satisfy his appetites as well as his whims. The successful man has the opportunity to satisfy hunger, the proper environment for sexual satisfaction and the rearing of young, protection from extremes of cold and heat, opportunity to travel and study, the chance to do about as he pleases. Social success is an aspect of biological success. The craving for superiority is based upon the urge to live and grow, expressed in a complex social environment by highly socialized individuals.

EFFECT OF A GROUP UPON INDIVIDUAL PERFORMANCE

Prestige motivation rests upon the distinction of one's self from others. It further presupposes an evaluation or rating of one's self in relation to others, and in various fields of competence. Prestige motivation is exceedingly fundamental. It underlies the phenomena of cooperation, team work, rivalry, competition, praise, reproof, as well as other social facilitations and inhibitions which will be considered in this and the following sections.

Almost any situation which singles out an individual from the group affects the speed or the quality of his performance, whether in the artificial conditions of a laboratory or in everyday activity. The presence of a group of spectators or an audience is likely either to facilitate or to inhibit activity. The musician, the lecturer, the actor, the preacher, and others who perform in public, are all more or less sensitive to the behavior of their audiences and affected by them. Even the mere presence of a co-working group in which no one individual is singled out affects the level of performance of the members of the group, as Allport has shown in the following experiments.

The Effect of Co-workers upon Individual Achievement. Allport performed a series of six experiments to discover how the presence of other individuals affects the achievement of the worker. In a laboratory environment he had his subjects carry out tasks alone (*A* conditions), and in groups of not more than five at a table together (*T* conditions).

He hoped to eliminate rivalry by telling the subjects that their work was not to be regarded as competitive, and by preventing any comparison of results among individual subjects. It is problematical as to how far rivalry was actually eliminated. (Moede found that rivalry developed spontaneously in a group of co-working boys.) Allport's subjects themselves reported a consciousness of rivalry, which indicates that it did play some rôle in influencing their performance. But quite apart from rivalry, common experience indicates that the placing of an individual in a social situation by having an audience present, or even a group of co-workers, does in some way heighten his awareness of himself and those about him, and does modify his behavior.

To describe behavioral changes dependent upon the presence of a group Allport coined several picturesque and convenient phrases. Taking a subject's performance level for solitary work as a standard, a quantitative increase while working in a group was called a *social increment*, and a corresponding loss a *social decrement*. From the qualitative point of view, gain in the group was called a *social supervaluent* and loss a *social subvaluent*.

The first of Allport's six experiments made use of free chain association. One hundred free associations were given by the subject in response to a stimulus word at the top of the sheet, and the time needed to write the words was recorded. Two of the three subjects showed a considerable social increment (9.3 per cent and 13.8 per cent); the other a small social decrement (3 per cent).

The second experiment continued work with free chain association, but utilized a larger group of subjects—a total of fifteen working in groups of five each. Solitary and group conditions were alternated systematically. The number of words written in a three-minute period was used as a measure. Fourteen of the fifteen subjects showed social increments of varying amounts. The average gain was 6.2 associations per three-minute period (mean variation 4.1). The greatest gain was made during the first minute of work and the least during the third minute.

There were also qualitative differences between the results under the two conditions. Eighty per cent of the subjects wrote more personal associations when alone than when in a group, whereas under the latter conditions words suggested by the immediate surround-

ings, and also "free rising" ideas (ideas occurring to the subject spontaneously, without any connection to the situation), appeared more frequently. The subjects reported an awareness of being "drawn out" by the presence of the group so as to produce associations of a more objective type.

Judging by statements of the subjects, the social situation apparently presented two clear-cut factors working in opposite directions: (1) an *impeding* influence, *i.e.,* sensory distraction, emotional excitement from rivalry and from self-prejudicial comparisons with others; (2) a *facilitating* influence derived from the suggestion that one's neighbor was working rapidly, and from self-imposed competition with him. The second factor was stronger than the first and served as an incentive to greater effort.

In a third experiment upon free chain association the subject was asked to write down every fourth word that occurred to him. This method was adopted because it was feared that, since associations come faster than one can write them down, the second experiment measured only the speed of writing. In treating the data the number of associations produced was multiplied by four. Results in this experiment indicated a distinct though less pronounced advantage of the social over the solitary conditions. Two subjects gave equivalent results in both situations, but of the remaining twelve, eight produced more associations in the group than alone. The consciousness of rivalry, though said to be slight, was reported by more than half of the subjects.

In a fourth experiment conditions were the same as above except that the subject thought of his own initial stimulus-word, and wrote down every third verbal association. There were eight subjects, in two groups of four each. The results of this experiment verified those of the foregoing ones. There was a social increment with 75 per cent of the subjects.

The fifth experiment confirms the previous results. The sixth was concerned with thought processes. Passages from Epictetus and Marcus Aurelius were selected which admit of considerable argument. The task of the subjects was to write down arguments to disprove a point which was made in the passage presented. Five minutes' time was allowed. Nine subjects worked in two groups. The experiment was carried on over a period of two months, with

systematic variations of solitary and group conditions, as well as of the passages used.

Each written test was graded upon the quality of argument by means of a scale. It is interesting that a greater variety of ideas was produced in the social situations than in solitary conditions, but that superior ideas were expressed in greater number when working alone.

"There is thus demonstrated a social subvaluent for argumentative or discursive reasoning. This finding is no doubt in accord with commonly observed facts of life. Who has not been aware, upon retrospection, of the low order of logical value in many arguments given under such a strong social influence as that of political meetings and oral debates? There seems to be a *spreading out* of our thought rather than a strong output of separate original ideas of logical worth. Group thought is *extensive*; individual thought is, to some extent, *intensive*." The verbal reports of the subjects bear some evidence that they were themselves aware of how they were reacting to the conditions of this experiment.

In general, Allport's experiments upon social facilitation and inhibition show that the presence of a co-working group is likely to speed up the individual's verbal associative processes, but that this effect is not a uniform one. The quality or meaningful character of the verbal processes also varies with the social situation, arguments produced in solitude being superior to those brought forth in a group.

Social Inhibition with Stutterers. Travis repeated Allport's experiment with a group of ten stutterers, using free chain associations. He found that eight of them produced more associations alone than when in a group. These results contrast sharply with those of Allport with non-stutterers, which showed experimentally that fourteen out of fifteen subjects produced more associations when working in a social situation than when alone. Also, Allport found greater variability in group than in solitary work, whereas Travis discovered the reverse to be true with stutterers. Thus the presence of a group, although it is usually facilitating to non-stutterers, is found to be inhibiting to stutterers.

Most stutterers can talk with little or no speech impairment when alone. Of twenty-five examined by Travis twelve had very little

trouble in speaking when alone, twelve had no difficulty whatever, and only one had as much speech impairment when alone as he did in a social situation.

Speaking is a social process, and speech disorders are linked up closely to social attitudes. Possibly the group-avoiding attitude of stutterers determined the difference which Travis found, for it is known that stutterers are to some extent socially diffident. Whether social maladjustments determine stuttering or the speech defect determines the unfortunate social attitude, or whether on the other hand both phenomena are determined by a third common factor, or whether all these possibilities are true in part; these are questions whose importance to human welfare demands that they be given careful study.

EXPERIMENTS ON COMPETITION AND RIVALRY

Nearly everyone is eager to excel in some way; even the two-year-old shows a tendency to better his meager accomplishments. The school child brings home some sample of penmanship, a drawing, or a map, and proudly displays it with the words, "See what I did!" This desire to excel, to win distinction, approval, recognition, praise —in a word, to gain prestige—is back of the phenomena of rivalry and competition.

The Motivational Effects of Competition in Sport: Bicycle Racing. Bicycle racing, which was a popular sport before the days of automobiles and airplanes, brought to light the interesting fact that the man who took the lead and set the pace usually lost the race. In the sport several types of races were evolved, and each man competed for championship in a particular style of race. In one type a man raced against time, and his sole aim was to beat a previous record made by himself or some other wheelman. In a different type of race the contestant was paced, either by a tandem or by several fast cyclists in turn; and it came to be recognized that the practice of pacing resulted in faster speed records than those made merely against time. In still another type of contest, competition was involved. It was discovered that in the competitive race the leading man had a disadvantage; usually in the final spurt the pacemaker dropped behind while the cyclist just behind him won the race. Consequently, the start of a competitive race was charac-

terized by "loafing," during which each man sought to force the others to take the lead and set the pace.

The advantage of being paced may be in part an actual physical one rather than purely psychological. Wheelmen came to believe that the pacing machine left a partial vacuum behind it, causing a "suction" effect which aided the bicycle directly following. The pacemaker, it was said, had to force his machine through the resisting air and hence became more quickly fatigued, whereas the following machine could always find shelter from the wind by selecting a position behind the pace-setter.

Some wheelmen said that, if a friend set the pace, it was an encouragement to the follower; others said that the man in the lead had "brain worry."* Still others assumed that attention to the revolving wheel of the pace-setting machine had an hypnotic effect upon the follower; he was said to move automatically, merely "hanging on" almost involuntarily. Triplett believed that there was a "dynamogenic" factor, or more simply that the sight and sound of the leading bicycle stimulated the racer to greater effort, and released in him energy which of himself he could not release. The conception of the "dynamogenic" factor was not clearly defined; competition played some rôle in it, but there was also said to be an element of suggestion.

To study competition under laboratory conditions which ruled out the complicating physical factors of the race, Triplett devised a simple experiment. The task of the subject was merely to turn the crank of a fishing reel, which is roughly analogous to turning one pedal of a bicycle. Two such cranks were arranged side by side, so that the turning could be done either alone or in competition.

The speed of turning the crank was instrumentally recorded. The experiment involved nearly 225 subjects, but the main report is based upon records from forty children, aged eight to seventeen (modal age eleven) years.

Triplett found that the effect of competition was not at all uniform. With most of the subjects, competition stimulated in a positive way which resulted in the making of faster time, but with some it

* An interesting collection of traditions and superstitions concerning bicycle racing, from which these illustrations are taken, is found in Triplett's study referred to at the end of this chapter.

worked adversely, retarding their speed of motion. In the latter cases competition brought loss of motor control which appeared to be dependent upon the competitive attitude of the subjects. This attitude was described by subjects as an intense desire or determination to win the race. The adverse effect of competition was shown externally by labored breathing, flushing of the face, and tenseness in the muscles of the arms. In other words, too firm a determination to make the best showing was sometimes disruptive to behavior and self-defeating. There was a small number of subjects who appeared to be little affected by the race; these were about equally fast when working alone and in competition. The last group suggests an analogous group of wheelmen who did about equally well in the paced and unpaced races.

Thus, more than thirty-five years ago, Triplett demonstrated experimentally that individuals differ in their reactions to competition. Most are spurred on by it; but in some, activity becomes disorganized and blocked; a few are little affected.

One of the psychological conceptions illustrated in this study is that of overmotivation. An exceedingly intense determination to win the race may lead to emotional disruption, bringing a motivational decrement, whereas a less intense determination may give an increment instead.

Rivalry in Relation to Rate of Tapping and Strength of Grip. We have seen that speed of reaction and strength of muscular contraction vary with motivating conditions. The effect of rivalry upon these same two factors was studied by Moede in two experiments in which he used as an index the speed of tapping and the strength of grip, comparing performance in a social situation with that when working alone.

In the tapping test, boys (aged twelve to fourteen years) were instructed to make as many dots as possible in the time allowed, using a pencil and a sheet of paper. The time limit for each test was thirty seconds.* When the boys worked in groups, rivalry developed spontaneously, the instruction being tacitly assumed by the boys to include the surpassing of competitors. There was every evidence of

* An electrically recording tapping board was used as a control. The speeds of tapping which were obtained with this apparatus were equivalent to those gained by paper and pencil technique.

genuine rivalry. Seeing one's neighbor work and hearing his insistent tapping developed an urge to surpass and to win. The experimenter observed a tenseness of muscle, and also that the dots were heavy ones. In some cases the competitive work was so vigorous that the pressure of skin against pencil drew a small amount of blood.

From Moede's tabulated results we have plotted the curves shown in Fig. 79. The average performance under the two conditions was

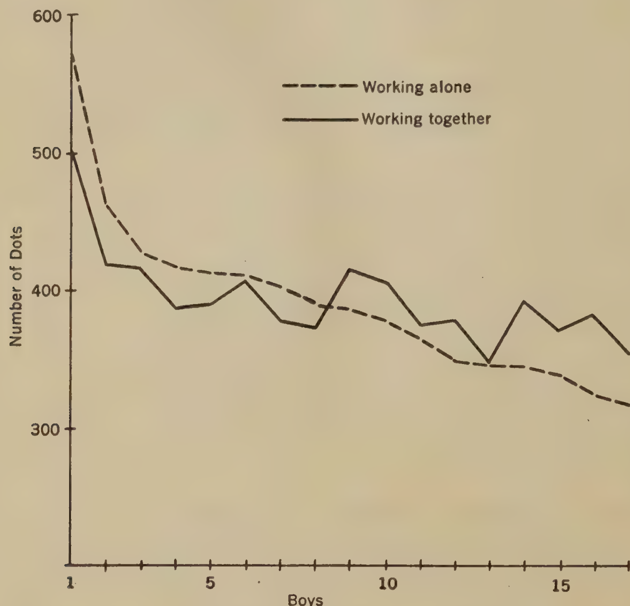

FIG. 79. TAPPING TEST OF SEVENTEEN BOYS UNDER SOCIAL AND SOLITARY CONDITIONS. (*Plotted from Moede's data.*)

The ordinates give the total number of dots made by each of the boys in two thirty-second periods. The dotted line indicates the rank order for tapping under solitary conditions, and the solid line the scores for the same boys working in a group, in which spontaneous rivalry developed.

about the same: for competitive work it was 396 points per minute; for solitary tapping it was 391. But the group as a whole was much more variable during solitary than during competitive work. For solitary work the mean variation was 11.3 per cent; for the performance in a group it was only 6.0 per cent of the average score.

The curves in Fig. 79 show that rivalry is a leveler. Under competitive conditions the faster half of the group slowed down and the

slower half speeded up. As shown by the preceding experiment of Triplett, rivalry does not change the work of all individuals in the same direction.

In a further experiment Moede measured strength of grip using a Collin's elliptical dynamometer. He sought to determine the effect of rivalry upon muscular strength. Each boy was given five trials and then after a pause five more; the ten were averaged, and the mean variation determined. The test was made both under solitary and competitive conditions with the following result:

	Solitary Work	Competition with Another Boy
Average pull	20.3 kg.	22.4 kg.
M.V.	16.5%	13.1%

Working in competition with one other boy thus gave about 10 per cent increase over the efficiency of performance for solitary work. Six weeks later the experiment was repeated with the finding that the competitive increment was 11 per cent.

Note that increased strength was accompanied by lowered variability. Unfortunately, Moede's conclusions in this particular experiment are based upon too small a number of subjects for a certain conclusion.

Competitive and Non-competitive Attitudes. The essential difference between competitive and non-competitive work is the attitude of the worker. Whittemore demonstrated this in an experiment which controlled attitudes through instruction. The subjects worked in groups of four. The task given them was that of copying newspaper material with a set of rubber type, which involved semi-mechanical movement and required constant alertness. The following instructions were used alternately:

1. *Non-competition.* "Try to get as much work done as you can, remembering that both the quality and the quantity of the work you do will count in your final score. Don't attempt to beat your fellow-workers."

2. *Competition.* "Try to beat your fellow-workers, remembering that both quality and quantity count in your final score. You may

use any method you see fit to employ in keeping track of the progress of your competitors. Compete!"

The quality of the work was graded by the experimenter on a scale varying from one to ten. The quantity score was the number of letters written per test, regardless of errors. The subjects were told that the measure of their achievement was the value obtained by multiplying quality by quantity scores.

The results indicate clearly that every one of the subjects produced considerably more work when competing than when working individually. A "competition index" was obtained for each subject by dividing the competitive by the non-competitive scores, and the following competitive indices, taken from the tabulated results, show the degree to which competition was effective.

Group I	Group II	Group III
1.21	1.23	1.24
1.26	1.26	1.33
1.36	1.34	1.29
1.21	1.25	1.14

The average competitive index is 1.26, which indicates a percentile gain through competition of about 26 per cent (P.E., 0.04).

In this experiment all subjects produced a distinctly poorer quality of work when they were competing than when working non-competitively. Thus Whittemore's study demonstrates that a quantitative increment and a qualitative decrement are induced by competition; and further it shows that competition depends upon the subject's attitude which, to a considerable extent, can be controlled by instruction.

Working for One's Self *versus* Working for One's Group. In playing on a football team, or fighting upon the battlefield, an individual loses his identity to a considerable extent and acts mainly as a member of the group. Everyone is familiar with group spirit, *esprit de corps,* loyalty to one's team.

There are obviously two forms of competition from the standpoint of the social situation: the first is, competing as an individual against another individual, or against one's own previous record; and the

second, competing as a member of one's group, for the success of the whole group. In experiments upon individual and group competition, Sims demonstrated the vast superiority of achievement when working for one's self over that when working for one's group.

The general plan of his experiments was to form three sections of equal initial ability, to instruct them to carry out a common experimental task under conditions which differed only in the type of competition, and to compare end-results. In a *control* section the subjects were urged to try to improve, but they were told nothing about their daily scores in the work and competition was not established. In a *group-motivation* section two equivalent groups were formed which competed against each other, with full knowledge of the scores and of the progress of both competing groups. In an *individual-motivation* section the subjects were paired and each kept his own record and that of a partner, with whom he was competing.

In one of the experiments the task was a verbal substitution test. The three groups of subjects—all of them college students—practiced word substitution three times a week for twelve practice periods. Using the average scores of the last two practice periods as a measure of final attainment, and comparing this with initial ability, Sims found the following increments in the number of substitutions per minute:

Group	Initial	Final	Per Cent of Improvement
Non-competitive control.......	36.0	72.8	102.2
Group motivation............	36.1	75.8	109.9
Individual motivation.........	36.2	93.8	157.7

The results show that all sections made a marked gain with practice. Group motivation gave improvement only slightly superior to that of the control group, but individual motivation gave results decidedly superior to those obtained with both other types of motivation.

In another experiment the Monroe Standardized Silent Reading Test, Form 2, was used to measure improvement in the speed of reading. After an initial test, three equivalent sections of fifteen subjects each were formed, the first a control group, the second using group competition, and the third, individual competition.

Reading practice in textbook material was given to all groups, and this was followed by the Monroe test. Those who are familiar with this particular reading test know that it consists of a series of passages followed by multiple-choice questions. The answers to the questions reveal the subject's comprehension and speed of reading. Inasmuch as the test is intended for grammar-school children, one may assume that the materials are easily understood by college students and that the scores are measures of the rate of reading.

Comparison of the initial and final rates of reading in terms of words read per minute shows the following increments in speed:

Group	Initial	Final	Per Cent of Improvement
Non-competitive control.......	167.3	181.9	8.7
Group motivation............	167.5	191.9	14.5
Individual motivation.........	167.7	226.0	34.7

These results are similar to those in the former experiment. *Individual motivation* proved markedly superior, in increasing speed of reading, to motivation in which the individual competed only as a member of the group. *Group motivation* was slightly more effective than *control motivation.*

A similar investigation is that of Maller, who compared working for social gain with working for personal gain. Using school children as subjects, he found that the latter motivation was decidedly the more effective.

Rivalry in the Class Room. Rivalry provides an effective form of motivation which can be used in the school room. In one of her experiments conducted in a public school of Harrisburg, Pennsylvania, Hurlock introduced rivalry to determine its effect upon work in arithmetic. The children were divided into two groups —*rivalry* and *control*—which were equated for age, ability, and distribution of the sexes. The two groups, equivalent in every respect, carried out their work in separate rooms. The control group worked with customary class-room motivation; the *rivalry* group worked with this plus rivalry, being divided into two subgroups which competed against each other.

On the first day of the experiment, the Courtis test of addition was given to all children for the purpose of selecting the groups.

On the second and following experimental days the two groups were treated differently. The experimenter explained to the *rivalry* group that the subgroups were equal in ability, that they were competing, and that each had the same chance to win. Rivalry was encouraged in several ways. After a day of competitive work the experimenter read the names of the members of the winning group, asking each child to rise as his or her name was called. This procedure gave social recognition to each individual as well as to his group. The score for the group, *i.e.,* the number of examples correctly added by the group as a whole per test period, was written on the blackboard and the experimenter, explained how far the leading group was ahead of its rival. She urged the defeated group to work harder.

The behavior of the children indicated that a genuine attitude of rivalry had been created. They worked with an intense enthusiasm similar to that seen in competitive sports. It is reasonable to assume that the gain in the rivalry group, over and above the practice gain shown by the control group, is a genuine measure of the influence of rivalry.

The scores made by the children in the addition tests are presented below for the five days of the experiment:*

	Day of Experiment				
	1	2	3	4	5
4th grade					
Control........	3.90	4.87	4.88	4.72	4.85
Rivalry........	3.69	7.00	7.63	7.99	8.24
6th grade					
Control........	11.24	11.62	11.75	11.51	11.54
Rivalry........	11.19	15.43	15.27	14.70	14.87

The scores of the older children, as we should expect, were consistently superior to those of the younger ones. The effect of rivalry is seen by comparing the results for the *rivalry* and the *control* groups on days 2, 3, 4, and 5, when rivalry was effective.

* Sigma and P. $E_{av.}$ values and other details are given by Hurlock.

Under control motivation the younger children made relatively greater practice gains than did the older ones, a fact to be borne in mind when interpreting the figures. Rivalry brought marked increments in scores at both age levels. Among various incidental results the following are of interest in the present context:

1. Rivalry proved more effective with children of inferior ability than with those of average or superior ability. On the last day the inferior children were 59 per cent, the average ones 35 per cent, and the superior children 37 per cent above the practice level of the control group.

2. The subsection of the rivalry group which was defeated on the first day of competition never overcame the initial loss, but stood, throughout, below the other section.

3. Sex differences were small, but the girls were slightly in the lead. On the last day the gain above practice was 46 per cent for the girls and 39 per cent for the boys.

In evaluating the use of rivalry in the class room, Hurlock writes enthusiastically:

> These results, taken as a whole, to include the sex, age and ability factors, point to the conclusion that rivalry is an effective incentive to use with children of the elementary school grades, as a means of inducing them to do better work in connection with their school studies. The interest which this arouses, the outlet for a natural desire to compete with others of equal ages, and the training which it gives in the building up of a cooperative spirit, as opposed to selfish individualism, justify its use. Even if it should lead to a tendency to decrease in accuracy of work, in the desire to accomplish more for the group, this fault is more than compensated for by the increased interest in school work, and the opportunity offered for development of character and personality.

PRAISE AND REPROOF

We assumed above that an urge to excel motivates rivalry and competition. This same craving for superiority renders encouragement and discouragement, praise and reproof, effective as incentives. Although rivalry reveals by actual test what a man can and cannot accomplish and, further, which individual is the best of his group, praise and reproof accomplish a similar result by means of words and symbolic expressions. The level of one's self-esteem is markedly

raised or lowered by what is said or implied relative to one's competence.

In an experiment by Gates and Rissland, college students were individually given two tests under different motivating conditions. During the first test all subjects were treated alike, but before the second trial the first subject was encouraged, the next to take the test was discouraged, the third was treated indifferently, the fourth encouraged, and so on. The subjects thus formed three experimental groups—*encouraged, discouraged,* and *control.*

Each subject was given a trial with a three-hole motor coordination test and a color-naming test, both before and after the special motivation. The first subject was encouraged with these words: "That is really splendid! Do you always make such good scores? In a curve of distribution your score would be way up here (indicating a position at the top of the curve). Your score was so good that I wonder if you would mind repeating the test?" The next subject was discouraged by the words: "Oh dear, that is really a very poor score. I am afraid that you would fall at the bottom of the curve of distribution, etc." The control subject was told nothing concerning his performance but was simply asked to repeat the test.

The following table shows what percentage of the subjects improved, remained the same, and fell off in their performance after the special motivation was introduced:

Test	Effect of Special Motivation upon Performance		
	Improved	Remained Same	Fell Off
Coordination			
Encouraged	89	0	11
Discouraged	70	4	26
Control	64	8	28
Color-naming			
Encouraged	58	4	38
Discouraged	51	9	40
Control	44	8	48

Although the differences between the effects of encouragement and discouragement are small, one can safely say that some comment to the subject about his performance was more effective than none at all, and that an encouraging remark was more effective than a discouraging one. Another interesting finding is that the subjects with relatively low initial scores were the ones most strikingly affected by discouragement, and those with relatively high scores were less affected by it.

Praise and Reproof. Encouragement and discouragement are so closely related to praise and reproof that the foregoing study logically belongs with this more elaborate investigation of the latter pair of incentives, by Hurlock. In studying the effect of praise and reproof upon the performance of a task Hurlock used different forms of the Otis and the National Intelligence Tests. The Otis test was used with third-grade children, the National test with fifth and eighth graders in the New York City schools. (See pp. 18-20.) On the basis of intelligence-test scores three groups of about equal ability were formed; there were 136 subjects in each group.

At a second meeting of the groups another form of the same test was used. Before presenting the test, two of the three equivalent groups were given special incentives in the form of instructions. The members of the first group were praised for their work in a carefully prepared speech, which follows:

Before beginning the test, I have a few things that I would like to say to you. I suppose you are wondering why I am giving you a test like the one you took last week? Well, I have just finished correcting all the papers for your grade, and I have selected you from the whole group who took the tests last week because of the very excellent work you did in that test. You not only made the best marks in your grade, but you did better than most boys (or girls) in grade (mentioning a grade several years higher than the one present) do in this test.

Let me say a few words about your papers. They were exceptionally neat, the answers were put in the right places, and although some of you did not answer all of the questions, what you did answer, you answered well, and this counts more than answering all and getting half of them wrong.

Today, I am going to give you a test like the one you had last

week. I want you to try not only to break your own record, but also to make this group stand first in the school, and set a standard for the others who do not do so well.

I know that you can all do even better than you did last time, so work carefully and try just as hard as you possibly can. Remember, you are not only trying to break your own records, but you are going to set a standard for the others in your grade.

The members of the second equivalent group of children were reproved before the test, in the following words:

Before beginning this test, I have a few things that I would like to say to you. I suppose you are wondering why I am giving you a test like the one you took last week? Well, I have just finished correcting all the papers of your grade, and I have selected you from the whole group who took the test last week because of the very poor work you did in that test. You not only did very badly in the test, but you are way below the standard for boys (or girls) of your age and grade. As the other boys (or girls) in your class did so well in this test, I know it isn't because you have not been taught these things in school. You have had the same chances to learn them as the others, but you just haven't tried.

Your papers were slovenly, careless, and you made mistakes that even a second-grade child would know better than to make. You are not supposed to answer all of the questions on every page, but what you do, you are supposed to do carefully and correctly. This will count more in the end than doing all and making a lot of careless mistakes.

I don't know whether you always do as badly in your school work as you did in this test. You certainly did badly enough in this test to feel thoroughly ashamed of yourselves, not only for your own sakes, but for your class record. It seems too bad for a group of boys (or girls) like you to bring down the class standard and hold back the others who really tried to do good work.

I feel that it is only fair to give you another chance. So, today you are to have a test like the one you took last week. I don't know if you can do any better than you did last time—in fact, I rather doubt if you can—but I am going to give you this chance.

The third group received neither praise nor reproof, but repeated the test performance under conditions similar to those on the first day.

The results show that praise and reproof were equally effective in raising the test scores. In the control group, 52 per cent of the children raised their scores on the second test. In the praised group, 79 per cent raised their scores; and in the reproved group, 80 per cent. The difference between the praised and the reproved groups is negligible, but the difference between both of these groups, on the one hand, and the control group, on the other hand, is statistically significant.

The motivational increments were examined in relation to age, sex, intelligence, race. Some interesting findings are summarized below:

1. The older children responded more, both to praise and reproof, than did the younger ones. It is possible that some other form of incentive, *e.g.,* reward and punishment, would be more effective with young children.

2. Boys made greater gains than girls both after praise and after reproof. In the control group (which lacked special incentives) the girls raised their score with practice more than did the boys.

3. Bright children, as shown both by the intelligence-test scores and by ratings of their teachers, were more influenced by the special motivation than were dull ones. Praise proved relatively more effective with inferior intelligence, and conversely, reproof was more effective with bright children. Commenting upon this last result Hurlock writes: "There is no question about the fact that in the ordinary class room it is the dull children who are constantly subjected to reproof for poor work, while the brighter children receive what little praise is given. From the recent work of Pintner and others, it is now clearly demonstrated that it is the 'inferior' children who are working up to capacity, while the 'superior' are working at a much lower level than their innate ability would permit. Hence, the inference is that the dull children of a class be encouraged whenever possible, and what reproof is used should be reserved for the most intelligent children who are satisfied with only average work."

4. Of the children studied, 37 per cent were colored and 63 per cent were white. The negro children reacted more favorably to praise than to reproof, and conversely the white children reacted more favorably to reproof. The differences, however, were slight.

The interpretation of this result is a matter of opinion. It may be that the relative effectiveness of praise and reproof varies with the degree of an individual's sense of inferiority or superiority. The social environment of the negro in all parts of the United States cannot help but build up an attitude of inferiority in him.

5. At the close of the experiment the children filled out a questionnaire which throws light upon their reaction to praise and reproof. They agreed that they tried harder after both praise and reproof and thought they did better with those incentives than in the original test. They believed that encouragement had a more lasting effect upon them than discouragement. They admitted that the reproof evoked a certain amount of fear—fear of not being promoted (for the children took the tests seriously as a part of the school requirement). Further, and not surprisingly, they said they enjoyed taking the test more after being praised than after being reproved.

The immediate effects of praise and reproof may be about the same, as shown by this study, but how about the more permanent effects when these forms of motivation are used consistently over a period of time? This question was raised by Hurlock in a second experiment. She asked: "In a classroom, do the children who constantly receive praise for their work show more improvement from day to day than do the children who are reproved or who are completely ignored?"

To study this question school children were required to take fifteen-minute tests in addition, which were repeated daily under systematically varied motivating conditions. Five forms of the Courtis Research Test in arithmetic were used. Each form contained thirty examples of equal difficulty made up of six three-digit numbers to be added, a different form being used on each experimental day. The subjects were 106 fourth- and sixth-grade children in a public school of Harrisburg, Pennsylvania.

On the first day of the experiment all the children were given the addition test together. On the basis of these results four groups of equal ability were formed. On the other days of the experiment one of these groups, regarded as a control, took the other forms of the test in another room. No comments were made except that the children were asked to add the examples on the paper. The motiva-

tion was the same as that for an ordinary class exercise. The other three groups worked in the same room but under different motivating conditions. One group was praised and another reproved. The final group heard both the praise and the reproof but was entirely ignored.

Before papers were given out the names of the children in the *praised* group were read aloud and the children asked to come to

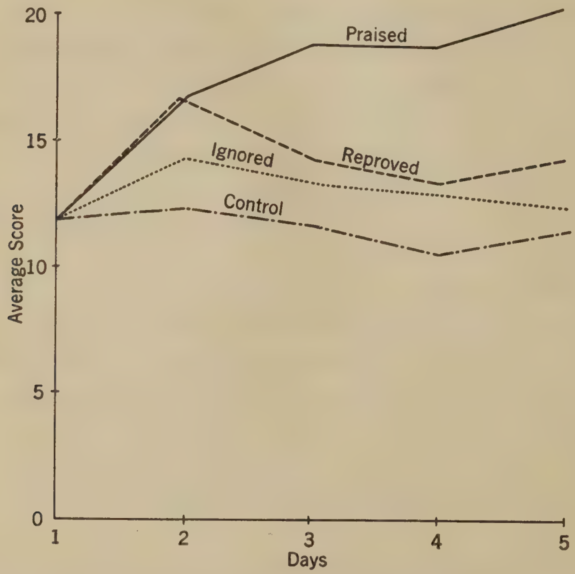

FIG. 80. AVERAGE SCORES IN ADDITION TESTS GIVEN UNDER DIFFERENT MOTIVATING CONDITIONS. (*Data taken from Hurlock.*)

A description of the curves is in the text.

the front of the room and face the class. They were then praised for the excellence of their work on the preceding day as shown by improvement, and for their general superiority over the other members of the class. They were encouraged to do even better, to try to avoid careless mistakes and to add more problems. After this the names of the children in the *reproved* group were called, and they were severely reproved for poor work, careless mistakes, failures to improve, and their general inferiority to other members of the class. The ignored group, as stated, although hearing the praise and the reproof, themselves received no recognition, favorable or

unfavorable. The contrasting efficacy of the different incentives as shown by their influence upon the children's performance, is clearly brought out by the curves in Fig. 80. On the second day the *praised* and *reproved* groups made equal gains, and both were superior to the *control* group. This confirms the result of the previous experiment in which there was only one repetition of the test. The improvement of the *ignored* group is midway between that of the *control* and the other groups. On the third, fourth, and fifth days, however, the *praised* group continued to increase its scores while the *reproved* group did not. At the close of the experiment the praised group was significantly superior to all the other groups. The gains of the *reproved* and *ignored* groups, over and above the practice gain of the *control*, were not large enough to give high significance to the differences. The *praised* group is the only one with a consistent increase in proficiency from the beginning to the end of the experiment.

After examining differences in performance dependent upon age, sex, ability, and other factors Hurlock concludes: "These results as a whole point conclusively to the fact that regardless of the factors of age, sex, initial ability, or accuracy, praise is decidedly the most effective of the three incentives here investigated. Reproof, when first used, seemed to be about equal in value to praise, but with continued use its effectiveness showed a decided decline. To ignore children in a group where the other members are receiving some incentive seems to be psychologically bad. The longer they are ignored, the less improvement do they show, even in spite of the opportunity to improve which comes from continued practice in one form of work. Hence, we may conclude that praise is the best form of incentive to use, no matter from what angle we may regard the matter."

Hurlock's conclusion favoring praise rather than reproof as an incentive cannot, without certain qualifications, be regarded as universally valid. For one thing, the degree of praise and reproof was not systematically varied, and until this is done one cannot be certain that all degrees of praise are superior to all degrees of reproof.

It is likely, also, that the relative effectiveness of praise and reproof varies with circumstances. On the football field, for example, severe reproof of the players for their errors, often in terms

both forceful and picturesque, is a method which coaches are commonly said to employ with success. It may be that this serves to counteract the ovations the players receive in the newspapers, the applause from the bleachers, and the adoration of fellow-students; preventing them from developing what their comrades call the "swell-head." Or it may be that reproof engenders anger and a hostile attitude which is readily redirected from the coach to the opposing team, for anger, as we know, is energizing. Thus, the claim that praise is always more effective than reproof runs counter to a common practice in the province of competitive sports, which lacks experimental support but nevertheless appears to work.

Again, the relative effectiveness of praise and reproof doubtless varies from individual to individual, and from situation to situation. We may guess that the degree of effectiveness has some relation to the general level of one's self-esteem. If an individual has an exalted opinion of himself, a little reproof might release more energy than would be yielded by praise. And if, on the other hand, a person has a distinct sense of inferiority, praise might be more effective in energy-release than reproof. It would be instructive to find some accurate method for studying experimentally the effects of praise and reproof in relation to self-evaluation, *i.e.,* to the level of self-esteem. Until scientifically valid evidence upon this relationship can be obtained and other studies have been made, it is best to be cautious in our generalizations about the effects of praise and reproof.

THE SOCIAL CONTROL OF BEHAVIOR THROUGH VERBAL SUGGESTION AND IMITATION

We have already discussed the rôle of words in the control of behavior (pp. 239-241). This social control of the individual is seen most clearly in the phenomena of verbal suggestion. The military command, the parent's order to the child, the psychologist's instruction to his subject, even the passing comment, are all potent in building up neural determinations which lead to action. The word can arouse a wish, a purposive set, a fear, or an attitude predisposing *towards* or *against* something.

In an instructive experiment, Strong studied the effect of positive and negative suggestion upon the strength of grip. The subject was

instructed to squeeze a dynamometer with maximal strength of grip. The positive suggestion, when given verbally by the experimenter, was: "Now you can make it stronger than usual." The negative suggestion was: "Now you can't make it as strong as usual." Positive and negative suggestions were also presented visually. Further, auto-suggestion was employed. The subject chose between positive and negative suggestions and spoke aloud: "Now I can make it stronger than usual," or "Now I can't make it as strong as usual."

The results for three subjects indicate that a positive suggestion heightened the strength of grip in every case except with the right hand of one subject (both right and left hands were tested). Auto-suggestion tended more strongly than the other types to increase the maximal grip. Judging from the comments of the subjects, suggestion had little effect; but dynamometer readings prove the contrary. Suggestion and especially auto-suggestion have something to do with the preparatory attentive set.

Another instance of the effectiveness of verbal suggestion is found in the muscle-reading, or the so-called "mind-reading," experiment. The author has repeatedly used this demonstration as a parlor trick and also at times in the class room. The procedure is as follows:

In the parlor someone is asked to hide a small object—perhaps a handkerchief, key, vase, book—while the "mind-reader" is out of the room. In doing the trick I first ask the subject to hold out his hand with the fingers slightly spread. I touch lightly the thumb, little finger, and wrist with my own finger tips, keeping the subject's hand at a comfortable, natural height. It is necessary to keep a definite pressure against the hand of the subject to detect all his impulses to move. Having established satisfactory contact I suggest that the subject think of the location of the hidden object, stating that I am going to move towards it. The suggestion is repeated from time to time. After a brief pause I start to move, letting the involuntary impulses from the subject's hand direct the course. Some individuals very quickly and quite unconsciously lead the "mind-reader" to the spot. Others present difficulties; they think *about* the object instead of *about finding* it, and *about moving* to its location. If the subject is slow in leading me to the hidden object, I make slight movements with the hand to the right, left, up, and down, noting carefully the resistance offered in different directions. The

line of least resistance to these impressed movements is regularly followed. Eventually the hidden object is found.

There are various secondary cues which aid—the silence and holding of the breath when the "mind-reader" is near the object, the spontaneous exclamations when it is touched, the glancing movement of the eyes towards the position of the concealed body. Success in interpreting these cues depends upon practice.

In the class room a somewhat different plan is needed. One procedure is to arrange from five to eight objects in a row in front of a long lecture table, then to have a student write upon the blackboard and erase the name of the one he will think about. This is done behind the "mind-reader's" back. The demonstration then goes along as in the parlor, repeating with several subjects, if necessary, until success is attained. After the demonstration the subject is asked if he consciously gave the "mind-reader" any help. He declares emphatically that he did not. Whatever cues he gave were unconscious ones.

The demonstration illustrates what has been designated ideomotor action. William James writes: "We may then lay it down for certain that *every representation of a movement awakens in some degree the actual movement which is its object; and awakens it in a maximum degree whenever it is not kept from so doing by an antagonistic representation present simultaneously to the mind.*"

Suggested Inhibitions. A lecturer once said to his audience: "I will give every one in this room a dollar who does *not* think of a red elephant while I count five. Remember, you are *not* to think of a red elephant—one, two, three, four, five." Of course, every one *did* think of the red elephant.

A mother once said to her small son: "Do *not* touch this pie." The negative suggestion put the idea of having some pie into his head; a new conflict was brought into existence. Parents should realize the importance of controlling behavior positively, so far as possible. Instead of "Thou shalt not," suggest a positive substitute; offer the boy a toy, a game, almost any definite course of action.

At one of the open houses of the psychological laboratory at the University of Illinois a student rigged up a demonstration of the effectiveness of negative suggestion. A box with a peek-hole was placed at one end of the hall, above the hole the words: "Do *not* look in here." Inside the box was an illuminated sign with the

words: "This is to demonstrate the effectiveness of a negative suggestion." So far as we know every visitor looked in the forbidden peek-hole.

Although a negative suggestion may lead to the very act which is prohibited, it is equally true that it may definitely inhibit the action. If the *don't* of a parent has in the past been reinforced by a slap, this *don't* effectively blocks the child's course of behavior.

In a demonstration of suggestion a group of subjects were asked to stretch out the arm at full length with closed hand. After a pause they were told forcibly and seriously that they could not open the hand if they tried to do so. Some opened it; but others tried in vain, their struggle being apparent in their muscular contractions. The prestige of the operator and his skill in handling suggestions are important factors in this demonstration.

Suggestion during Hypnosis. Light hypnosis may be induced by holding a crystal or other bright object before the eyes of the subject, instructing him to fixate it while thinking about nothing but going to sleep. Fixation develops eye strain; after a while the eyes close and he appears to be asleep. After a few minutes the operator says: "Now I shall count three, and when I snap my finger you will wake up." The finger is snapped and the subject opens his eyes. Probably he states that he was not asleep at all, and that he heard clearly everything that happened, but simply felt a little tired. The experiment is repeated, however, this time with a different suggestion: "When I count three you will try to open your eyes but be unable to do so." This is repeated: "When I count three you will not be able to open your eyes." After the counting the subject can be seen struggling to raise his eyelids; the brows are raised and the facial muscles strained, but the lids remain closed. Later the operator says: "When I count three and snap my finger you will open your eyes and wake up." This is done and the subject awakens.

Under deep hypnosis pain may be eliminated through suggestion. Limbs have been amputated, babies delivered, without pain, during hypnosis. Total or partial blindness can be produced. For example, if the operator suggests that Mr. *X* (one of the witnesses) is no longer present in the room, the subject will count those present omitting Mr. *X*. It is also true that positive hallucinations can

be aroused through hypnotic suggestion. If told that there is a locomotive puffing near by, the subject will act as if he heard it. If given an imaginary canoe, he will sit down cautiously and row with an imaginary paddle. After a subject awakes he is unable to recall what was said and done during the trance.

Therapeutic Use of Verbal Suggestion. Waking suggestion is a recognized psychotherapeutic measure. If an individual is told emphatically that he is healthy, free from pain and worry, and that all is well with himself and the world, these suggestions build up in him an attitude conducive to well-being.

The work of Emile Coué is widely known. He instructed his patients to sit down quietly in their rooms whenever they experienced a pain, to shut the eyes and pass the hand lightly over the forehead or other painful part, repeating the words: "It is going, it is going, it is going, etc." The essential point in the technique is to repeat the words "It is going, it is going, . . ." so quickly and frequently that any contrary thought cannot be expressed. When one thinks the pain is going it vanishes. If it should return, the words "It is going, . . ." are repeated.*

Imitation. Suggestion, as described in the foregoing account, is a process of controlling behavior through words. The spoken word is capable of building up a mental set in the individual, or of restraining a purposive determination already in existence. If an individual is determined to carry out some course of behavior but is inhibited by counter-determinations, the word can often remove the blocking and thus release the predetermined action. Words of praise and reproof, as we have already seen, may markedly facilitate or inhibit an activity in progress. Thus in all these ways the word is a potent instrument of social control.

There is, however, another kind of social control which is nonverbal in nature; it is known as imitation. Conscious or deliberate imitation is illustrated by the game of follow-the-leader in which the children are set to reproduce the antics of the leading child. This kind of imitation is also exemplified by the student of dancing who attempts to reproduce the steps of his teacher, and by the

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* For further discussion of suggestion see the excellent work by Hull, reference 28, at the close of this chapter.

violinist who strives to duplicate the tone, accent, phrasing of his master.

As distinct from this conscious imitation there is an unconscious mimicry clearly seen in the behavior of children and of some animals. Not long ago the author's two-year-old daughter met a panting dog in the park. Quite spontaneously she opened her mouth and breathed with quickened respiration, imitating the panting animal. This reaction was repeated several times when other panting dogs were encountered. Köhler has printed the picture of a chimpanzee climbing a shaky pile of boxes and reaching toward a suspended banana. On the side line is another chimpanzee observing the performance, making a reaching gesture with his arm as if he, too, were about to reach out for the fruit.

When one watches a tight-rope artist one feels himself into the situation—losing balance, regaining it, walking the rope, finally crossing successfully. Again, the spectators at a football game can be seen during a long run to make incipient movements toward the goal as if they themselves were carrying the ball down the field. Finally, when an experienced driver rides on the back seat of an auto he automatically presses his foot upon an imaginary brake-pedal in the traffic crisis. In all these cases there is an unconscious identification of one's self with some other individual and an empathic duplication of his behavior.

We copy the gestures and verbal mannerisms of persons who have prestige. We imitate their style of dress. We tend to accept the attitudes of those with whom we mingle. To a considerable degree we are all imitators.

THE DETERMINANTS OF BELIEF (ATTITUDE)

We defined an attitude as passive mental organization which predisposes an individual towards or away from a verbal statement (p. 242). When a direct question is asked, the individual expresses belief (assent), disbelief (dissent), or doubt (uncertainty). These reactions are regulated by the mental organization; they are, in fact, the outward indications of existing attitudes. The conceptions of *belief* and *attitude* are intimately related. Belief or disbelief is the expression of attitude; attitude is known only through the beliefs and disbeliefs which are expressed. The question "What deter-

mines belief?" is indistinguishable from the question "What determines attitude?"

Primitive Credulity. Years ago Bain made some interesting comments about belief. He said that the child is credulous, believing what he is told unless there is some reason to doubt it. This fact Bain referred to as "primitive credulity." The genuineness of Santa Claus, the truth of biblical stories, the authenticity of the stork legend or the doctor's-bag story, the accuracy of all the explanations given him by his elders, are taken for granted by the child. It is only when some incompatible statement is made that doubt arises.

Man likes to regard himself as a rational creature and to assume that his beliefs are based upon direct observation and reflection. This is in part correct. My own belief that the full moon appeared last night is based upon observation, direct experience. All of us, however, accept statements on authority. It is not the child alone who assents to the beliefs that his parents have held; nor only the young pupil who accepts with little questioning the beliefs of his teacher and the statements of his textbook. For the layman, whatever is printed in a book is likely to be believed. Even the daily newspapers represent authority to the masses, and their printed words control attitudes and hence behavior on many matters.

Belief and Desire. When a transatlantic airplane, long overdue, has not been heard from, the wife of the pilot affirms her belief that her husband is safe. In bereavement, especially when it comes suddenly, the bereaved individual refuses to believe that the loved one is dead. The craving for the return and continued existence of the one lost determines a belief which to an outsider may appear wholly irrational.

In an interesting experiment by Lund a set of thirty questions was drawn up, dealing with topics of general interest in the fields of religion, ethics, politics, and science. Several groups of subjects (243 in all) were asked to indicate the strength of their belief or disbelief of these items by referring to a belief scale with twenty steps. This scale had a positive and a negative side; it ranged from plus ten through zero to minus ten. After completing these ratings for strength of belief, the subjects were asked to rate the same ques-

tions again on a scale of desire. They estimated the degree to which they desired the content of the items to be true or not true. The rating scales are given below.

Scale of Belief		Scale of Desire	
10. 9. 8.	Belief allowing for no doubt.	10. 9. 8.	Highly desirable.
7. 6. 5.	Fairly strong belief.	7. 6. 5.	Quite desirable.
4. 3. 2.	Slight belief—an element of doubt.	4. 3. 2.	Somewhat desirable.
1. 0. −1.	Absence of both belief and disbelief.	1. 0. −1.	Indifferent.
−2. −3. −4.	Somewhat inclined toward disbelief.	−2. −3. −4.	Somewhat undesirable.
−5. −6. −7.	Fairly strong disbelief.	−5. −6. −7.	Quite undesirable.
−8. −9. −10.	Disbelief allowing for no doubt.	−8. −9. −10.	Highly undesirable.

The thirty questions which were judged in terms of belief and again in terms of desire are reproduced in the following list.

1. Was Lincoln an honest and upright man?
2. Is a democracy the best form of government?
3. Does a black cat crossing your path cause bad luck?
4. Were the higher forms of life derived from the lower forms through a gradual process of evolutionary growth?
5. Will the death penalty for murder always be held justifiable among civilized peoples?
6. Did the whale swallow Jonah?

7. Do molecules exist?
8. Did Shakespeare write "The Merchant of Venice"?
9. Is Christianity losing its influence in this country?
10. Is the earth practically round?
11. Do only the good die young?
12. Is slander wrong?
13. Are there other beings besides myself?
14. Will monogamous marriage continue to be the only socially accepted relation between the sexes?
15. Will our Republic continue to exist a hundred years from now?
16. Should all men have equal political rights?
17. Do air vibrations constitute the stimulus for hearing?
18. Does death end personal existence?
19. Is morality a man-made institution?
20. Do two plus two equal four?
21. Is a man's conduct determined entirely by his heredity and environment?
22. Did the world come into existence through the creative act of a divine being?
23. Does the earth travel around the sun?
24. Is the protective tariff a wise policy for the United States?
25. Do animals have feelings similar to our own?
26. Is the sun the source of light?
27. Do any landscape paintings yield as much satisfaction as the finest natural scenery?
28. Is the Golden Rule a practicable concept in business relations?
29. Will traffic in liquor ever be entirely abandoned?
30. Did the dinosaur ever exist?

The ratings made it possible to determine the relation between belief in the truth or falsity of a statement, on the one hand, and desire that the proposition be true, on the other. The graphic representation of results in Fig. 81 demonstrates a very high degree of agreement between the two ratings. That is to say, there was a marked tendency for the belief in a given statement to be attended by a desire of the same relative strength that the proposition be true. The correlation coefficient was $+0.81$. Another set of propositions (selected for a different purpose) gave a coefficient of $+0.76$

between belief and desire. These relationships are interesting even though it cannot be claimed that they explain anything.

The Pathology of Belief. In a very readable essay, *Delusion and Belief,* Campbell points out that no sharp line can be drawn between normal belief and what a psychiatrist calls delusion. Inasmuch as the psychiatric cases throw light upon the bases of normal belief, a few illustrations will be cited.

FIG. 81. GRAPHIC REPRESENTATION OF RELATIONSHIP BETWEEN THE BELIEF IN PROPOSITIONS AND THE DESIRE THAT THEY BE TRUE. (*After Lund.*)

The twenty-point scale of belief and of desire is shown on the vertical at the left. The numbers beneath the base line designate the propositions judged. Average ratings for the group of subjects are plotted. The propositions are ranked in a descending order of belief (solid line), and the corresponding degree of desire for each one is shown (dash line).

A woman in the prime of life was suddenly bereft of her mother. "After her mother's death she would go every evening to the mother's room and sit in her chair. She would have to sit in the room for at least ten minutes before she would hear her mother's voice; and then, as her mother would talk, she seemed to see her lying in bed just as she was before her death. The daughter would go to her mother's door every night to bid her good-night, and would frequently go into the room and sleep for some time and

feel comfort and relief from these visits to the room which still seemed inhabited by the spirit of her mother."

This is a borderline case in which the reactions are merely exaggerations of the normal ones to bereavement. The biological urge to live, the wholly irrational longing to continue existence in some form or other, is probably the basis for the belief in individual immortality. In the face of death this belief satisfies a want; for the individual facing the world it serves as an instrument of adjustment.

Another case, also involving hallucinations, is the following: "An unmarried woman of sixty-four began to be disturbed by finding that she was the object of attention of various men whom, as a matter of fact, she did not see and whom she could not identify. Voices, however, said they wanted her. She heard the voices of the plotters arranging to take her away in a yacht. Young millionaires in automobiles kept circling around her place of residence. She was so much afraid of being abducted and carried away in the yacht that she appealed to the police for protection. The patient claimed that she had seen God, the Virgin Mary, and the angels, and felt that this was not insanity but was a gift given her."

Unlike the previous case this woman was obviously psychotic, but the form taken by her delusion can be explained on the basis of normal wishes which have long remained unsatisfied. The abnormal experience resembles a normal day-dream, but with this important difference: the psychotic patient accepts all these fanciful experiences as reality, whereas the day-dreamer knows that he is imagining things.

The longing for children is a desire which molds one's beliefs. A childless woman "astonished her husband one day by saying that she was going to the doctor to demand her child, and said that she was sure that this doctor, many years ago, had taken away her baby. She claimed that she had recently seen her baby, now grown to boyhood. As she gave fuller rein to her imagination and became less critical, she claimed that she had had a series of children." This case is also psychotic, but based upon a normal desire.

The craving for power and prestige is basic in human nature. When an individual faces inferior qualities in himself, compensatory reactions are set up. Note the following case: "A young man

with complete self-confidence, unable to see any abnormality in his own mental condition, erroneously thought that his father had a mental disorder, and that those in his environment were immoral. He felt that he had ability and power to advise the community, and he published a pamphlet on health and other pamphlets on love. The pamphlet on health 'guarantees cure in any non-epidemic disease and assures to you long life and health by easy method.' In the other pamphlets he gives dogmatically his views about love, courtship, and marriage, and gives advice in a somewhat pretentious way to those who are about to marry. The self-satisfied and superior attitude of the individual, accusing those around him and posing as a leader, is in striking contrast with his actual personal limitations. From early years he had suffered from deafness; pulmonary tuberculosis and a mental upset had put an end to his college training. On restoration to physical health, he had carried on unskilled work or lived with his people. The strong desire for success which inspired him was not quenched by the actual situation. He felt that success must be his, and with no training or competence in regard to dietetics, he felt that his individual experience entitled him to lay down the law on the subject, and published his pamphlet which guaranteed long life and health. He attributed such importance to his views that he referred to them as likely to upset and revolutionize present medical science."

The above cases show in a striking way how an unsatisfied craving develops a compensatory belief. An individual's attitude literally *makes* the conscious field what it is, in the normal as well as in the abnormal sphere. Whole ranges of belief rest upon non-rational motivations.

In the present connection a basic psychological principle should be mentioned. The subjective certainty which an individual experiences in regard to the truth or falsity of any proposition is relative to his own attitudes. This is obviously true for delusions. It is equally true for normal beliefs in the fields of religion, morals, politics, philosophy; even men of science hold to their views with conviction.

Determinants of Belief. Lund investigated the factors mentioned by his subjects as belief determinants. On the basis of the study he selected the following list of factors as being important in determining belief.

A. Public Opinion.
   Beliefs fostered through a general attitude of acceptance by people at large.

B. Personal Reasoning.
   Acceptance determined by a rational process, a definite "thinking it out."

C. Desire and Satisfyingness.
   Beliefs embraced because they satisfy or embody conditions that are desired.

D. Teaching and Training.
   Belief conditioned by instruction received at home, through the church, school, or similar institutions.

E. Axiomatic Principle.
   Principles which cannot be doubted, being imperative in commanding belief.

F. Personal Opinion.
   Beliefs for which no real account can be given except that one thinks they are so.

G. Personal Experience.
   Acceptance engendered through sensory experience or observation.

H. Authoritative Opinion.
   Acceptance determined by the prestige given through official or authoritative attestation.

This list indicates that the determinants of belief are both rational and non-rational. Experience and observation (G), reasoning (B), are rational bases for belief. Perhaps also self-evidence (E) should be regarded as a rational factor. But apart from these the remaining grounds for assent contain a large non-rational element. We have beliefs for which we can give no explanation (F). We assent because others do (A); we believe what we desire to be true and what satisfies us (C); we agree to what we are taught in the home, church, school (D); especially do we believe the opinions which are expressed by persons with prestige (H). Thus our attitudes are formed not only through the senses and the intellectual processes, but also by our wishes and by other non-rational determinants.

CONCLUDING STATEMENT ABOUT SOCIAL MOTIVATION

The human individual is a dynamic organism embedded within a social environment. To a high degree his biological appetites find

their satisfaction through cooperative work with other individuals of the group. Thus men cooperate in producing and distributing food, clothing, coal, and the other goods which satisfy human wants.

In seeking to satisfy his biological needs and to gratify his every whim the individual must communicate with others. The socialized man controls others by speaking, ordering, instructing, suggesting. Through words and gestures he builds up attitudes and purposive determinations. Words can facilitate or inhibit an activity in progress; they can release mental blockings so that an individual is left free to act. Words of praise and reproof can energize the individual who is embarked upon some course of action. Words, therefore, are potent instruments of social control.

Power, dominance, standing, prestige, or whatever you call it, can be measured in terms of one's ability to control his social environment. Whatever impresses an individual with his own inadequacy or failure is typically reacted to with compensatory behavior, aimed at gaining standing or prestige. The urge to excel is found in every sphere of activity—physical, intellectual, economic, moral, and all others.

Viewed from the standpoint of motivation, therefore, the social environment is highly important. This environment is not conceived as something distinct and apart from the physical, but rather as one aspect of the total external situation. The human social environment is made up of persons and the total stimulations an individual receives from them; to some extent it contains the manifold products of human activity. Social motivation is the process by which energy is released and its expenditure directed or channeled by factors within the social environment.

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CHAPTER IX

EMOTION AND MOTIVATION

> "One of the most important lessons of experience is learning to distinguish between the facts of observation and the inferences drawn from those facts."
>
> —Walter B. Cannon

In 1806 John Coulter was returning from Oregon with Lewis and Clark.* He stopped at the Missouri river to hunt and trap. At the time he was thirty-five years old, five feet ten inches tall, a typical western pioneer somewhat like Daniel Boone.

He and his companion Potts were proceeding up the Jefferson river (the most western of the three forks of the Missouri) each in his canoe. Suddenly a war party of about 800 Black-Feet Indians appeared on the east bank. The chiefs ordered them to come ashore. Coulter obeyed, feeling that flight was useless and hoping for robbery only (he had dropped his traps into the shallow river). He was seized, disarmed, and stripped. Potts refused to come ashore. He was shot in the hip by an Indian, falling, then quickly rising and shooting an Indian dead. In an instant a hundred bullets pierced his body. Many savages rushed into the stream, and pulled the canoe ashore. They dragged the body up onto the bank and with hatchets and knives hacked and cut it to pieces. The entrails, heart, lungs, etc., they threw into Coulter's face.

The relatives of the killed Indian were enraged and struggled, tomahawk in hand, to reach Coulter, the others holding them back. He was expecting every moment the death blow or fatal shot. A council was hastily held to determine his fate. He expected to die by the tomahawk, a slow, lingering, horrible death.

They had magnanimously determined to give him a chance,

* This illustration was used by W. B. Cannon in his classic work upon emotion, but it is here quoted with slight modifications from the original source: James, General Thomas. *Three years among the Indians and Mexicans.* Publ. by Missouri Historical Society, 1916.

though a slight one, for his life. After council, the chief pointed to the prairie and motioned him away with his hand, saying in Crow language "Go—go away." He supposed they intended to shoot as soon as he was out of the crowd and presented a fair mark to their guns. He started in a walk. The old Indian gave impatient signs and exclamations and told him to go faster, and again repeated with more violent gestures as he still walked.

When he had gone a distance of eighty or a hundred yards from the army of his enemies he saw the younger Indians throwing off their blankets, leggings and other incumbrances as if for a race. Now he knew their object. He was to run a race, of which the prize was to be his own life and scalp. Off he started with the speed of the wind. The war whoop immediately arose; and looking back, he saw a large company of young warriors, with spears, in rapid pursuit. He ran with all the speed that nature, excited to the utmost, could give; fear and hope lent a supernatural vigor to his limbs, and the rapidity of his flight astonished himself.

The Madison Fork lay directly before him, five miles from his starting place. He had run half the distance when his strength began to fail and the blood to gush from his nostrils. At every leap a red stream spurted before him, and his limbs were growing rapidly weaker and weaker. He stopped and looked back; he had far outstripped all his pursuers and could get off if strength would only hold out.

One solitary Indian, far ahead of the others, was rapidly approaching, with a spear in his right hand, and a blanket streaming behind from his left hand and shoulder. Despairing of escape, Coulter awaited his pursuer and called to him in the Crow language, to save his life. The savage did not seem to hear him, but letting go his blanket, and seizing his spear with both hands, he rushed at Coulter, naked and defenseless as he stood before him, and made a desperate lunge to transfix him. Coulter seized the spear, near the head, with his right hand, and exerting his whole strength, aided by the weight of the falling Indian, who had lost his balance in the fury of the onset, he broke off the iron head or blade which remained in his hand, while the savage fell to the ground and lay prostrate and disarmed before him.

Now was his turn to beg for his life, which he did in the Crow language, and held up his hands imploringly, but Coulter was not in a mood to remember the golden rule, and pinned his adversary

through the body to the earth by one stab with the spear head. He quickly drew the weapon from the body of the now dying Indian, and seizing his blanket as lawful spoil, he again set out with renewed strength, feeling, he said to me, as if he had not run a mile. A shout and yell arose from the pursuing army in his rear as from a legion of devils, and he saw the prairie behind him covered with Indians in full and rapid chase. Before him, if anywhere, was life and safety; behind him certain death; and running as never man before sped the foot, except perhaps, at the Olympic games, he reached his goal, the Madison river and the end of his five mile heat.

Dashing through the willows on the bank he plunged into the stream and saw close beside him a beaver house, standing like a coal-pit about ten feet above the surface of the water, which was here of about the same depth. This presented to him a refuge from his ferocious enemies of which he immediately availed himself. Diving under the water he arose into the beaver house, where he found a dry and comfortable resting place on the upper floor or story of this singular structure.

The Indians came up, searching for him, and even stood on the roof of his refuge. He feared they would break it open or set fire to it but they did not. Then they crossed over the river and he rested dry, till night.

The cries of his terrible enemies died away in the distance. All was still. He ventured out (under water again). He swam the river and hastened toward the mountain gap thirty miles above on the river. Fearing the Indians might have guarded this pass (the only outlet from the valley), Coulter ascended the almost perpendicular mountain before him, the top and sides of which a great way down, were covered with perpetual snow. He clambered up this fearful ascent about four miles below the gap, holding on by the rocks, shrubs and branches of trees and by morning had reached the top.

He lay concealed all day. At night he proceeded in the descent of the mountain, then on three hundred miles over the plain toward the Fort. He traveled day and night, stopping only for necessary repose, and eating roots and the bark of trees, for eleven days. He reached the Fort, nearly exhausted by hunger, fatigue and excitement. The blanket was his only clothing, the spear head his only weapon.

His beard was long, his face and whole body were thin and emaciated by hunger, and his limbs and feet swollen and sore. The

company at the Fort did not recognize him in this dismal plight until he made himself known. Coulter now with me passed over the scene of his capture and wonderful escape, and described his emotions during the whole adventure with great minuteness. Not the least of his exploits was the scaling of the mountain, which seemed to me impassable even by a mountain goat. As I looked at its rugged and perpendicular sides I wondered how he ever reached the top—a feat probably never performed before by mortal man. The whole affair is a fine example of the quick and ready thoughtfulness and presence of mind in a desperate situation, and the power of endurance, which characterized the western pioneer.

The almost superhuman exploit described above can be duplicated from stories of exploration, adventure, and war. In times of strenuous activity the organism is able to mobilize stores of energy which under normal conditions are latent. Even if we allow generously for the universal desire to tell a good story, the fundamental truth remains that there is an increased energizing of the organism during the stress of an emergency.

In his delightful essay upon the *Energies of Men*, William James wrote that there are within us reservoirs of energy:

The existence of reservoirs of energy that habitually are not tapped is most familiar to us in the phenomenon of "second wind." Ordinarily we stop when we meet the first effective layer, so to call it, of fatigue. We have then walked, played, or worked "enough," and desist. That amount of fatigue is an efficacious obstruction, on this side of which our usual life is cast. But if an unusual necessity forces us to press onward, a surprising thing occurs. The fatigue gets worse up to a certain critical point, when gradually or suddenly it passes away, and we are fresher than before. We have evidently tapped a level of new energy, masked until then by the fatigue-obstacle usually obeyed. There may be layer after layer of this experience. A third and a fourth "wind" may supervene. Mental activity shows the phenomenon as well as physical, and in exceptional cases we may find, beyond the very extremity of fatigue distress, amounts of ease and power that we never dreamed ourselves to own, sources of strength habitually not taxed at all, because habitually we never push through the obstruction, never pass those early critical points.

THE SIGNIFICANCE OF EMOTIONAL REACTIONS

There are two seemingly opposed views regarding the significance of emotional reactions. One of these regards emotion as an integrated, biologically serviceable form of activity; the other as a disruption or disorganization of behavior. These views will now be considered in some detail.

Emotional Reactions as Adaptive. The great Darwin, who was a pioneer in the study of emotional expression, claimed that emotional processes are archaic or primordial types of behavior which must be interpreted in the light of biological evolution. Darwin believed that many reactions, emotional as well as non-emotional, are vestiges of formerly useful acts, reversions to an earlier pattern. Just as there are vestigial organs in the body so there are behavior patterns which hold over from early biological activity. An example of behavioral atavism which is non-emotional in character follows. The dog turns around several times before lying down on the parlor floor. The act is apparently senseless, but it can be interpreted, Darwin believed, by reference to the past. The biological ancestors of the dog were wolflike creatures which had to trample down a bed on the grassy plains before lying down for rest and sleep. On the hardwood floor of a parlor this formerly adaptive act is meaningless, but it can be understood by reference to its serviceableness in the remote past.

A good many of the expressions of emotion, according to Darwin, are responses which are biologically adaptive under former circumstances. For example: "Kittens, puppies, young pigs and probably many other young animals, alternately push with their fore-feet against the mammary glands of their mothers, to excite a freer secretion of milk, or to make it flow. Now it is very common with young cats, and not at all rare with old cats of the common and Persian breeds . . . when comfortably lying on a warm shawl or other soft substance, to pound it quietly and alternately with their fore-feet; their toes being spread out and claws slightly protruded, precisely as when sucking their mother. That it is the same movement is clearly shown by their often at the same time taking a bit of the shawl into their mouths and sucking it; generally closing their eyes and purring from delight. This curious movement is com-

monly excited only in association with the sensation of a warm soft surface; but I have seen an old cat, when pleased by having its back scratched, pounding the air with its feet in the same manner; so that this action has almost become the expression of a pleasurable sensation."

The modern psychologist would attempt to determine how far the foot and toe movements associated with sucking had been acquired through conditioning, and how far they were innately determined. Apart from this problem Darwin's principle remains: some apparently useless responses were useful at an earlier stage of development.

Darwin further claimed that the *facial* expressions of the emotions can be explained by referring to biologically useful reactions such as shading the eyes from light, dilating the nostrils for easier breathing and olfaction, preparing the teeth for biting and the mouth for mastication. The utility of these changes in the facial muscles is obscured under present-day conditions, but from the evolutionary standpoint their former serviceableness is quite apparent.

Crile is among the more modern writers who have accepted the Darwinian point of view towards emotional behavior. Emotion, he believes, is to be understood in terms of "phylogenetic association." For example, throughout the course of evolution, bodily injury has been repeatedly associated with painful struggles; this association has become firmly built into the bodily structure of the present-day organism. Fear is phylogenetically associated with running away from danger. Anger is associated biologically with an attack to vanquish opposition. Love, from the evolutionary standpoint, is related to copulation and care of the young. When any one of these basic activities is called into play an emotion appears both in the facial expression and in gross behavior. Even though the emotional response is useless at the time it is evoked, and even though the expression is incomplete, inhibited, or distorted by conventional requirements of the social group (*e.g.,* not to cry in public) these fundamental emotional processes can still be interpreted in the light of their original biological setting.

Craig has supplemented Darwin's hypothesis by pointing out that emotional reactions are socially and psychologically significant. Ex-

pressive behavior, he states, is important because it is perceived and understood by other individuals. Emotional reactions are useful as a means of communication, and for the control of one individual by another; they have developed as adaptations toward this end. The vocal cords and other muscles of expression have been evolved on account of their usefulness in the process of controlling other members of the social group. "The cat with her back up, her tail thickened, and with spitting and growling, tells her tormentor, more forcefully than words could tell it, that she is ready to scratch and bite."

The expression of human and animal emotion was explained by Darwin in terms of three principles. The first, which he referred to as the *principle of serviceable associated habits*, has been described above; it stresses the biological utility of emotional behavior. The second, which he designated the *principle of antithesis*, is related to the first.

The *principle of antithesis* is simply that opposite emotions such as anger and joy have opposed expressions. When a pattern of emotional reaction has been firmly established, Darwin believed, it is natural that actions of a directly opposite kind, even though useless, should be performed unconsciously under the opposite emotional state. For example:

When a dog approaches a strange dog or man in a savage or hostile frame of mind he walks upright and very stiffly; his head is slightly raised, or not much lowered; the tail is held erect and quite rigid; the hairs bristle, especially along the neck and back; the pricked ears are directed forwards, and the eyes have a fixed stare. [Darwin illustrates with pictures.] These actions, as will hereafter be explained, follow from the dog's intention to attack his enemy, and are thus to a large extent intelligible. As he prepares to spring with a savage growl on his enemy, the canine teeth are uncovered, and the ears are pressed close backwards on the head; but with these latter actions, we are not here concerned. Let us now suppose that the dog suddenly discovers that the man he is approaching, is not a stranger, but his master; and let it be observed how completely and instantaneously his whole bearing is reversed. Instead of walking upright, the body sinks downwards or even crouches, and is thrown into flexuous movements; his tail, instead of being

held stiff and upright, is lowered and wagged from side to side; his hair instantly becomes smooth; his ears are depressed and drawn backwards, but not closely to the head; and his lips hang loosely. From the drawing back of the ears, the eyelids become elongated, and the eyes no longer appear round and staring. It should be added that the animal is at such times in an excited condition of joy, and nerve-force will be generated in excess, which naturally leads to action of some kind. Not one of the above movements, so clearly expressive of affection, is of the least direct service to the animal. They are explicable, so far as I can see, solely from being in complete opposition or antithesis to the attitude and movements which, from intelligible causes, are assumed when a dog intends to fight, and which consequently are expressive of anger.

The *principle of antithesis* is descriptive rather than explanatory. It describes the observed opposition between expressions of joy and of hostility. Allport has suggested that this antithesis applies not so much to total emotional patterns as to their affective components—the contrast between pleasant and unpleasant reactions.

According to Craig, one should view antithesis in the light of social interaction and communication. To illustrate, when a dog is prepared for attack, his bodily posture and behavior are readily understood by other animals as well as man. Now the inhibition of this hostility-set is accomplished by an antagonistic reaction which communicates to others the absence of a hostile determination, *i.e.,* friendliness. If the antagonistic set merely counterbalanced the hostile reaction, the dog's behavior would be indifferent, but there is generally an overcompensating which gives the familiar pattern of friendly behavior. In line with this thought, Darwin wrote: "Man himself cannot express love and humility by external signs, so plainly as does a dog, when with drooping ears, hanging lips, flexuous body, and wagging tail, he meets his beloved master."

The dog did not invent the emotional expressions, nor does he clearly understand what is happening when he uses them. In human communication, however, emotional expressions of the facial muscles are controlled and modified voluntarily. They are employed as are words and non-emotional gestures to convey meaning.

Darwin recognized that the two foregoing principles of emotional expression were not fully adequate to account for all the

facts. In addition to the *principle of serviceable associated habits* and the *principle of antithesis*, Darwin described as follows a third: "*principle of actions due to the constitution of the nervous system, independently from the first of the will, and independently to a certain extent of habit.*" Examples of bodily changes explainable by the third principle are: the loss of color in the hair during terror, trembling in fear, gnashing of the teeth and writhing in agony, clapping the hands and jumping up and down in joy.

The third principle frankly recognizes that some emotional expressions are useless. They can be interpreted only by an appeal to the constitution of the nervous system apart from all utility and apart from antithesis to biologically useful or formerly useful acts.

Emotional Reactions as Disruptive. The view that an emotion is a disorganization of coordinated behavior has been widely held by psychologists. Thus, in the context of emotion Watson writes: "There would seem to be no question, but that the immediate effect of the exciting stimuli upon organized activity . . . is always disruptive. If an individual is preparing a lecture or writing a book or rendering a musical selection, any strong emotional stimulus at least temporarily disrupts and blocks the organized activity."

Again, Claparède writes: "Emotions occur precisely when adaptation is hindered for any reason whatever. The man who can run away does not have the emotion of fear. Fear occurs only when flight is impossible. Anger is displayed only when one cannot strike his enemy. . . . The uselessness, or even the harmfulness of emotion, is known to everyone. Here is an individual who would cross a street; if he is afraid of automobiles, he loses his composure and is run over. Sorrow, joy, anger, by enfeebling attention or judgment, often make us commit regrettable acts. In brief, the individual, in the grip of an emotion 'loses his head.'"

In keeping with the view that emotion is a disorganization of behavior is the fact that fear and anger retard the process of habit formation. This is known to be true both with man and many varieties of animals. In the case of the frog, Yerkes wrote: "A certain amount of excitement undoubtedly promotes the formation of associations, but when the animal is frightened the opposite is true. I have no hesitation in stating that, in the case of the green frog,

any strong disturbing stimulus retards the formation of associations. . . . Quiescence, it is to be remembered, is as frequently a sign of fear as is movement, and one is never safe in saying that the frog is not disturbed just because it does not jump."

Higginson has reported that anger and fear disturb the process of maze learning in the rat. Anger was aroused by pinching the rat's tail and stimulating the nose. Fear was induced by placing the rat inside a cage with a cat, the rat being confined to a smaller inner compartment. Immediately after the emotional excitation the rat was tested on the maze. The learning process of the emotionally excited animals was compared with that of the non-emotional controls. The emotionally aroused animals showed an increase in the following values: the time spent in running, the total time consumed in learning the maze and the number of trials needed to master it; the variability from trial to trial; the total distance traversed; the number of errors made. In other words, emotionally excited rats were more prone to enter blind alleys; they were more variable and slower in maze learning than quiescent animals.*

That an emotional disturbance makes the human subject unsteady in his movement can be illustrated by Laird's findings upon the effect of razzing. Every baseball fan is familiar with the practice of razzing the umpire, the pitcher, or the batter; the razzing consists of personal remarks which range from mildly discouraging to highly uncomplimentary, or even to actual insults. We assume here that such razzing evokes an emotional response.

Laird attempted to determine the effect of razzing by using a series of simple motor tests which were given to eight fraternity pledges under two conditions. First, the tests were made under conditions of friendly competition. The active members of the chapter and the other pledges watched the performance of each individual; respectful silence was maintained, and each pledge did his best to outstrip the others. Two nights later the tests were repeated under similar conditions except that by previous arrangement there was free-for-all razzing of the pledges which, Laird reports, was beyond doubt genuine and effective. On the second occasion the pledges were brought into the room one at a time. Tests were made of the

* Inasmuch as anger and fear are antagonistic to hunger, these effects might be referred to a reduction of the hunger drive.

speed of tapping, muscular coordination (three-hole test), and steadiness of movement while sitting and while standing.

Results show that for all subjects there was a loss of steadiness during razzing. The standing test of steadiness revealed the greatest alteration; this test-performance utilizes the gross leg and trunk muscles as well as the finer ones of the arm.

In the tapping test and the muscular-coordination test the result of razzing was not so uniform. In tapping speed five subjects showed a gain and three a loss, under razzing, which reminds one of Moede's result with a tapping test, namely, that rivalry speeded up some subjects and slowed down others (pp. 401-403). In the muscular-coordination tests three subjects showed a gain and five a loss, but the general average for the group reveals a loss of motor control during razzing. The most uniform result of razzing, however, so far as Laird's experiment is concerned, is its disorganizing effect upon the steadiness of movement.

The Kinds and Conditions of Emotional Disruption. According to the Yerkes-Dodson law as determined by the discrimination technique (pp. 280-287), the speed of habit formation increases up to a certain point as the strength of the electric shock which is used as punishment is augmented. The law implies that beyond a critical intensity further increase of incentive results in a slowing down of the learning process. The law states that the optimum degree of motivation for a given task varies inversely with the difficulty; and that for any given task retardation of learning occurs if the degree of motivation is raised above the optimum. This law demonstrates the validity of the conceptions of undermotivation, overmotivation, optimal motivation.

Not only overmotivation or overstimulation, as noted above, but also any blocking of a strongly aroused impulse brings a disorganization of behavior. When the course of behavior runs smoothly, emotion is absent. Free activities such as walking, eating, and adding figures are typically non-emotional; undisturbed purposive acts go along indifferently, or possibly with mild interest to the subject. But when thwarting of a powerful motive occurs and the cerebral control of behavior is reduced, there is an emotional outburst. With animals, too, the frustration of any strongly aroused impulse is sure to evoke a show of emotional excitement. As

Claparède said in the above quotation, fear occurs when flight is impossible, and anger is displayed when one cannot strike his enemy. Sexual feeling turns into emotion when the impulse is blocked.

The child of six or seven years is highly impulsive. An activity which has been clearly suggested to him is generally carried out with little or no restraint. He has very great difficulty, as Luria has shown, in delaying an action for which he has been specifically prepared. When a prepared action is restrained by such words as "Don't do that," "If you do that, you'll be spanked," the conflict expresses itself in crying and through struggling to carry out the impulsive act. Thus, if the child wants to play with a toy, to examine some object, to ride a bicycle, to eat a piece of pie, and if the desired activity is blocked, emotion occurs. When blocking is removed, as by giving the child something he wants, the emotion of joy appears. The joyful child jumps up and down and runs around in general excitement.

With the adult, as with the child, thwarting of any strongly motivated activity is a cause of emotional excitement. Obvious examples can be found in the sphere of thwarted sexual motives. Uncertainty as to the outcome of a love situation heightens sexual emotion. The period of courtship is one in which sexual emotion is more marked than during married life—largely because of the uncertainty, the delay, the arousal and partial thwarting of the sexual urge. Direct and uninhibited sexual union is not so highly emotional an experience as that which is delayed by a period of sexual play.

One special kind of thwarting of the sexual urge is that which occurs when there is a rival. In the triangular situation of two males and one female, or two females and one male, the obstructed expression of sexual behavior may lead to anger and attack, or possibly to fear, grief, or to an attitude of resentment or jealousy.

Another very common condition of human emotion is the conflict between sexual motives and moral principles. Free sexual expression is held in check by mental attitudes which are based upon moral and religious training; the individual may believe that all sexual activity is sinful and unclean (which attitude is a hindrance to a satisfactory marital adjustment). There are also fears—of pregnancy, social disgrace, of disease—which inhibit the natural expres-

sion of the impulses of sex. Further, one's sense of self-esteem and standing in the community (prestige motivation) often blocks sexual expression. In polite society open displays of the sexual impulses and even verbal references to sex are taboo. Except in persons who marry young, all these counter-sexual factors thwart the sexual impulses in such a way as to heighten conflict and emotionality.

A distinctly different cause of emotional disruption is found in the case of grief and weeping. Grief is induced by the loss of something which is valued; the loss brings a disturbance of mental equilibrium, maladjustment. Lund has made a careful study of weeping by observing the situations which induce weeping at funerals and the theater. He found, as we noted on p. 372, that people became lacrimose when the unpleasant situation gained a redeeming feature—when some alleviating circumstance appeared. Emphasis upon the redeeming feature accentuated the conflict and maladjustment. Likewise in watching a play, the audience is prone to weep when the hero, in a tragic situation, displays courage, self-renunciation, or kindness, or when succor comes to him from an unexpected source.

The disruption of laughter occurs when there is a marked upset of mental equilibrium. A sudden transition, an abrupt change from one mental organization to another, will bring laughter if the change be a happy one, *i.e.,* a shift which elevates one's self-esteem, or releases inhibited sexual impulses, or condemns one's enemy, or presents one with a novel and unexpected situation, or imaginatively satisfies some desire. At the instant of transition laughter occurs and persists until a readjustment of mental equilibrium has taken place.

Allport believes that laughter is an innate response to stimulation of the sensitive zones or ticklish spots of the body. The elemental joke consists in being tickled. As the infant develops, the range of things that come to be laughed at is extended by experience. Allport writes:

The most obvious thing about tickling is that it represents a great fuss about nothing. It is the light touches and pokes that evoke laughter. But it is also true that the ticklish zones overlie some of the most vital organs of the body. Hence there is something terrible

in a thrust at these parts which throws into relief the antagonistic pleasant emotion aroused by the playful outcome of the thrust. The tickler moreover does not miss the opportunity of making the feint as sudden and terrifying as possible in order to get the heartiest peal of laughter from the child when the latter finds he is only being tickled. This is precisely the situation in numerous funny events of daily life. There is a sudden passage from a strained expectancy to nothingness (Kant's theory of humor), or else a rapid shift from bigness, weight, or seriousness to the small and inconsequential (Lipps). It is the humorous passage from the sublime to the ridiculous. Fun of this type is common on the stage and in the circus. The acrobat takes a running leap and somersaults over four horses. The clown then runs down the platform in swaggering imitation, but suddenly stops and brushes a fly from the nearest horse.

Not only is the transition effected between contrasting and incongruous situations; it is also a *sudden* transition. Suddenness, physiologically considered, means the abrupt change from one type of attitude to another. . . .

The specific conditions which produce emotional disruption are protean. Countless situations induce rage, terror, agony, weeping, laughter, and so on; and the outer expression of these major emotions varies with the situation. The one thing all emotions have in common is this: behavior is disorganized, disrupted; the individual for the time loses control of himself. When emotional, he lacks poise, composure.

Whether the disorganization is aroused directly by the outer situation, or whether it is induced by an imaginative reliving of the past, the fundamental nature and psychological significance of the disturbance are the same. *An emotion is a disintegration of behavior, a symptom of imbalance of motivating conditions within the personality.*

How Can These Views Be Synthesized? The view that emotion is a serviceable reaction has been much strengthened of late by the physiological investigations of Cannon and his collaborators, who have demonstrated in detail the biological utility of the internal bodily processes of emotion. These important researches will be considered later in this chapter. For the present it is best to

admit that emotional behavior contains biologically useful components such as snarling, snapping, clawing, and the like, and that the internal bodily changes of certain emotions prepare the organism for vigorous activity. In the proper environment a great many of the bodily changes of emotion do appear to be serviceable to the organism in its struggle for existence.

Proceeding on the basis of the Darwinian assumption one can pair off adaptive behavior and emotion as follows:

Adaptive Behavior	Emotion
Fight or attack upon enemy	Anger, rage
Flight, escape from danger	Fear, terror
Copulation	Sexual love
Nursing, care of young	Maternal love

This plan is suggestive of McDougall's parallel lists of the instincts and conscious emotions.

The list is incomplete. Even Darwin admitted the presence of useless elements in many emotional manifestations. If one stresses the disorganizing, disruptive character of emotion, one can pair off the cause of disruption with the resultant emotion, and arrive at a wholly different list, as follows:

Cause of Disruption or Maladjustment	Emotion
Loss of loved person or of something valued	Grief
Presence of "sickening" object	Nausea, disgust
Sexual rival	Jealousy
Loss of self-esteem	Humiliation (negative self-feeling), or other emotion such as resentment, envy, anger, depending upon the situation
Sudden disturbance of the mental equilibrium producing a happy result	Laughter

According to the view that emotion is a disorganization of behavior, strongly motivated patterns of adaptive and integrated activity such as fighting, escaping from danger, copulating, must be sharply distinguished from emotion. Emotion occurs only when behavior is inhibited, thwarted, blocked, when stimulation is too intense, or when there is some marked disturbance of mental equi-

librium. The more definite and widespread the disorganization the more certainly is the reaction an emotional one.

Now we do not have to choose between the two main interpretations of emotional excitement. Both appear to be correct. Consequently our task is to bring them into true relation with each other. In doing this several points need to be made:

Behavioral patterns which are highly adaptive in one situation are often entirely useless in another. For example, all the bodily processes of anger are useful when a man is forced to fight a wild beast in the forest, but the same physiological changes are harmful when this man is attending a formal dinner party and, losing his temper, threatens to fight. The internal organic changes which enabled Coulter to escape with his life from the Indians were highly serviceable, but they would be disintegrating if his goal were to give a lecture, play a concert, or write a scientific book. Being in love is biologically useful when the reproductive urge can express itself freely, but this same state is disruptive to the college student who is trying to master a history lesson. Adjustment and maladjustment, adaptation and disruption are, after all, relative to the environmental situation as well as to the organism.

Again, the cerebrum is an inhibitor of the primitive reactions which are regulated by the subcortical centers. These biologically primitive activities are adaptive in the cruel situations of the jungle, and, for better or for worse, they dominate behavior when cerebral control is lost. During an emotion an individual literally loses his head; cerebral control and regulation are disturbed; there is a regression to the archaic patterns of life-preserving activity. Thus it is true that the loss of cerebral control brings disintegration of delicately coordinated behavior; it is equally true that many of the behavioral patterns to which the emotionally excited organism reverts are, or once were, biologically adaptive.

One final point needs to be stressed in this discussion. The question of whether emotions are disruptive or adaptive is, after all, one of *interpretation* rather than *fact*. A purely factual study of emotional excitement is possible, and this, indeed, is the most truly scientific approach to the problem. Emotional reactions *do* occur in nature, regardless of how psychologists interpret them. Let us, then, examine emotional processes from the *factual* standpoint.

THE DEFINITION AND CLASSIFICATION OF EMOTIONAL PROCESSES

The literature dealing with emotional behavior contains numerous descriptions of the expressive movements which appear when an organism is emotionally excited. These outward signs of emotion are evident even to the most casual observer. Consider, as an example, the account of rage in Darwin's classical work:

> We will now turn to the characteristic symptoms of Rage. Under this powerful emotion the action of the heart is much accelerated, or it may be much disturbed. The face reddens, or it becomes purple from the impeded return of the blood, or may turn deadly pale. The respiration is laboured, the chest heaves, and the dilated nostrils quiver. The whole body often trembles. The voice is affected. The teeth are clenched or ground together, and the muscular system is commonly stimulated to violent, almost frantic action. But the gestures of a man in this state usually differ from the purposeless writhings and struggles of one suffering from an agony of pain; for they represent more or less plainly the act of striking or fighting with an enemy.

Again, consider Mantegazza's picture of the physiognomy of fear:

> The skin becomes white and cold, and later, damp with sweat; the heart beats violently and irregularly, then becomes slow; respiration is laboured, the hair stands erect as under the influence of cold. If fear increases until it becomes terror, the sides of the nostrils dilate; the eyes open disproportionately, and contemplate the object which causes us so much fear; they may even be unconsciously turned and move convulsively from side to side. The muscles of the face are convulsed; the whole body may oscillate like a pendulum and present spasmodic movements of a different nature; finally, muscular paralysis gives to the body the aspect of a corpse or of imminent syncope; and the bowels, relaxing, allow all they contain to escape.

In such descriptions a great many bodily processes are mentioned: changes in respiration, dilation and quivering of the nostrils, trembling, affected voice, clenching and grinding of the teeth, violent action of the gross muscular system, posturing of the body for the act of striking or fighting, convulsive movement of eyes and facial

muscles, oscillation of the body, muscular paralysis. These and similar changes prove that there exists a widespread involvement of skeletal muscles and of the cerebrospinal nervous system. The quickening of the heart, the reddening or paling of the face, the pouring out of sweat, the erection of the hairs, the relaxing of the bowels, the dilation of the pupil—these are the surface manifestations of profound internal bodily changes which, as we know, are regulated through the autonomic nervous system and chemical agents in the blood.

The Etymology of Emotion Words. The word "emotion" is derived from the Latin *e* (out) and *movere* (to move). Originally the word meant a moving out of one place into another in the sense of a migration. Thus: "The divers emotions of that people (the Turks)" (1603). "Some accidental Emotion . . . of the Center of Gravity" (1695). The word came to mean a moving, stirring, agitation, perturbation, and was so used in a strictly physical sense. Thus: "Thunder . . . caused so great an Emotion in the air" (1708). "The waters continuing in the caverns . . . caused the emotion or earthquake" (1758). This physical meaning was gradually transferred to political and social agitation, the word coming to mean tumult, popular disturbance. Thus: "There were . . . great stirres and emocions in Lombardye" (1579). "Accounts of Public Emotions, occasioned by the Want of Corn" (1709). Finally the word came to be used to designate any agitated, vehement, or excited mental state of the individual. Thus: "The joy of gratification is properly called an emotion" (1762).

In describing emotional and conative states, writers commonly refer to the parts of the body presumably determining those states. In the Bible one reads the phrase "bowels of mercies." Shakespeare in *Lucrece* writes: "To quench the coale that in his liver glowes." In a record from Waltham Abbey dated 1554 are these words: "This bishop was bloody Bonner, that corpulent tyrant, full (as one said) of guts and empty of bowels; . . ." Modern slang contains similar phrases: "He has plenty of gall"; "He got his spleen up"; "He could not stomach it"; "Have a heart"; "He lacked the guts"; "Es ist ihm etwas über die Leber gelaufen (He is peeved)."

This reference to those body-parts which are strongly affected during emotional excitement was found also in a study by Kurath

upon the semantic sources of words which designate feelings and emotions in Sanskrit, Greek, Latin, and the Germanic languages. Kurath's etymologic study shows that emotion names have been derived from previous words designating the parts of the body involved in emotional reaction (heart, breast, viscera, gall, liver, spleen), from the responses of the body to emotional situations (cries, interjections, irregular breathing), from sensory presentations which determine emotional experiences. To illustrate, a few examples are chosen. The words at the left are the earlier meanings, and those at the right the meanings derived from them as the language grew.

Earlier Word Meanings	Later Word Meanings
Grasp	Desire, greed
Tremble	Fear
Blush	Passion, love, delight
Make noise	Rejoice
Grumble, grind the teeth	Anger, wrath, sorrow, grief
Various interjections	Wail, suffering, sad
Vigor, strength	Passion, courage, daring
Labor, toil	Suffering, misery, distress
Play	Amusement, mirth

It will be seen that the earlier words designate behavior or behavioral characteristics more definitely than do the later ones. Some of the terms which refer to feelings and emotions developed from words which designate the sensory presentations and complex activities which are known to be associated with feeling. A few examples follow:

Earlier Word Meanings	Later Word Meanings
Bright, shine (visual)	Delight, pleasure
Dark	Gloomy
Sweet	Pleasant, joyful, glad
Rub, scratch, bite, gnaw, sting	Pain, grief, sorrow
Heavy	Distress, grief
Bear, carry	Endure, suffer, dare
Crush, break	Pain, grief, regret
Thirst	Desire, craving
Weak, weary, droop, slow	Sad, dejected, grief, sorrow

Words which mean joy, delight, grief, sorrow have multiple origins as do these affective experiences in life itself. All things considered,

an etymological study brings us back to concrete bodily processes and situations.

The Classification of Emotions. The student of human emotions might reasonably expect to find here a well-developed and commonly accepted classification of emotional processes. Unfortunately such does not exist. More than seventy-five years ago Bain worked out a classification of emotions, referring to still earlier attempts. More recently Shand and McDougall developed elaborate systems of emotion on the basis of much empirical observation and keen analysis. Their work is worthy of serious study by students of motivation, but their elaborate systems do not agree with those of other psychologists. Seashore devised a classification of emotions based upon part of Mercier's earlier work. Marston has developed his own system of emotions. Stratton has presented a simple and useful diagram which shows the interrelation of emotions, stressing the fundamental importance of undifferentiated emotional excitement. After William James had labored through the descriptive literature of emotion he paid his respects: "But as far as 'scientific psychology' of the emotions goes, I may have been surfeited by too much reading of classic works on the subject, but I should as lief read verbal descriptions of the shapes of the rocks on a New Hampshire farm as toil through them again."

There are nearly as many classifications of emotions as there are classifiers. One difficulty lies in the great variety of names for human emotional experiences. In a study of the emotions portrayed in photographs of facial expression Kanner gathered together 365 terms descriptive of emotion. Of course, one cannot argue from words to psychology; many of the words do not have equivalents in other languages, and there is much overlapping of meaning. The ordinary emotion names designate meaningful attitudes rather than patterns of bodily response. Human life is so rich in complex emotionalized attitudes that to make a simple and complete classification of them is a well-nigh hopeless task.

The major difficulty with the various attempts to classify the emotions lies in the absence of general agreement as to the definition, as well as in the lack of a common basis for classification. Obviously, a scientifically sound and practically useful classification of

emotions can result only when a valid definition and a sound basis for classification are at hand.

Watson attacked the problem *de novo* by observing the emotional behavior of infants in response to controlled stimulations. He excited infants in various ways: by making a sudden loud noise, by letting the infant drop or pulling the sheet on which he rested, by restraining free arm and leg movements, by stroking erogenous zones, rocking, patting, etc. Despite the variety of stimulations, Watson reported that only three emotional patterns of response could be found. These he called fear, rage, love. This Watsonian trinity, based as it was upon experimental observation, was widely accepted and placed straightway in the textbooks of psychology.

Then Sherman came along, repeating Watson's work with certain modifications. He stimulated infants by inducing hunger, by suddenly dropping, by restraining head and face movements, and by sticking them with a needle. To gain permanent and objective records Sherman photographed the responses of the infants with a motion-picture camera. The films served as a basis for his study. They were shown to several groups of judges, all presumably qualified to pass upon human behavior: graduate students in psychology, medical students, nurses in a training school, and normal-school freshmen.

In preparing the films a sharp distinction was made between the stimulating circumstances and the emotional responses. In one set of pictures the stimulating circumstances and the ensuing responses were presented; the judges were instructed to name the emotion portrayed. In the case of hunger the judges were simply told the period of food deprivation. In another set of pictures only the emotional responses were shown, stimulating circumstances being deleted. The judges were instructed as before to name the emotion and also to judge the nature of the stimulation which had probably induced the response. In a third set the stimulating circumstances and emotional responses were transposed in the film. Again the judges were required to name the emotional response. Finally, the infants in flesh and blood were stimulated behind a screen, which was thereupon removed. In this case the judges were requested to name the emotion on the basis of direct observation of

the response which, of course, included the cries. The hunger reaction was not attempted in the last series.

Results show that, if stimulating circumstances were absent from the film, the judges could not agree as to the appropriate names for the emotions. The students of psychology described emotions in terms of their psychological vocabularies, using such words as anger, fear, pain, hunger—but these designations showed a wide scatter among the judges for each expression presented for judgment. Students of medicine did no better than the budding psychologists. When the stimulating conditions were concealed behind a screen the responses were variously called pain, fear, anger, hunger, colic; but there was almost no uniformity or agreement among the judges. With the other group the result was the same whenever knowledge of the stimulating circumstances was withheld.

With those films which portrayed the inducing situations followed by the emotional responses, the agreement of judges was much greater than when the exciting circumstances were unknown. If one knew that the baby had been deprived of food (hunger), or pricked with a needle (pain), or dropped (fear), or that his free bodily activity had been restrained (rage), one could then name the emotional response with much more certainty and in agreement with others than when such knowledge of the evoking conditions was lacking.

In one of Sherman's experiments the cries of infants were presented to the judges without knowledge of the inducing circumstances, and judgment of the emotional characteristics of the voice was required. Again there was a wide dispersion of judgments with very little agreement among the judges. In this same experiment a trained vocalist attempted to convey emotion through the medium of his voice; the judgments showed a wide scattering, except when the vocalist intended to convey sorrow or anger.

Sherman's work demonstrates that differentiations among fear, hunger, pain, and rage, cannot be reliably made on the sole basis of the infants' responses. It seems probable in view of what we know about the development of behavior that these responses do resemble each other in infants and that true differences develop later with growth and experience. Certainly the ontogenetic sequence is from diffuse and general behavior to the more differentiated, spe-

cific patterns. All the emotions studied by Sherman belong to the *unpleasant* group. Had he employed stimulations to induce such pleasing reactions as cooing and smiling, I think easy and consistent differentiation of the pleasant from unpleasant emotions would have been made by most judges. This test should certainly be made.

It is clear from Sherman's result that Watson had complete knowledge of the stimulating circumstances as well as the responses when he made his threefold classification. His knowledge doubtless influenced him unknowingly. In line with Sherman's work is another investigation made by Landis, who employed a series of still and moving photographs of facial expressions in response to situations designed to produce real emotion. Among the situations employed were listening to classical and jazz music, looking at pictures including works of art, pornographic pictures, views of skin diseases, reading of sex case histories, placing the hand in a bucket of frogs, receiving an electric shock. Landis also photographed various voluntary attempts to express the traditional emotions.

The subject's face was marked so that it was later possible to measure on the photograph the extent of involvement of the different groups of facial muscles. The varying degrees of muscular involvement were measured and results tabulated. The tabulation proved that for a given situation there was very wide variation of facial expression among the subjects. No expression or group of expressions typified any of the situations in the experiment, apart from the smile. It was found that some subjects favored special groups of facial muscles to the exclusion of others, which fact, Landis believed, gives a basis for the "mannerisms" of facial expression recognized by everyone. Most individuals revealed a tendency toward the non-reaction of particular muscle groups.

Landis states that he could not find any correspondence between the photographed patterns of facial expression and the names used by the subjects to describe their emotions. Further, when some of the "most expressive" photographs were submitted to judges who were instructed to consider each one carefully, and to state what feeling or emotion the subject experienced and what kind of stimulation might have induced it, these judges were unable to make statements concerning the name of the emotion with any greater

precision than by chance; nor could they guess the probable situation which gave rise to the expression! No facial pattern characterized any particular feeling.

The results of Landis stand opposed to the earlier conclusions of Feleky, Langfeld, Ruckmick, and others, regarding the ability of judges to identify emotional expressions from the face. This discrepancy Landis explained by saying that the photographs used by other investigators were not true portraits of the facies of emotion, but rather pictures of the socialized and to a large extent conventionalized reactions which supplement speech. It is certainly true that we use our facial muscles in communication to convey emotional meanings just as we use our gross musculature to gesture and our vocal cords to speak. The earlier investigators had some actor portray an emotion, and the pose was then photographed and used as material for the judges. This pose was recognizable, Landis stated, because it was a conventional expression, similar to the spoken word; but the pose was not a truly emotional response. It seems to the writer that Landis's extreme position may have to be modified somewhat, but his negative reaction is a wholesome one in that it points out sources of error in other work.

In classifying emotions, therefore, it is important to distinguish between the primitive reflex expressions such as the snarl, the flow of tears, on the one hand, and the conventional expressions derived from the social environment and utilized in communication, on the other. The distinction is supported by a brief study of Gates which shows how children develop in their ability to interpret pictures representing facial expressions, and in their ability to judge emotions from the auditory element.

All things considered, the experiments of Sherman and of Landis point to a major difficulty in classifying emotions and suggest why it is that the previous systems of emotion have not come to general agreement. The trouble is this: the emotions which we commonly recognize—grief, laughter, fear, anger, love, jealousy, pride, humiliation, and the rest—are conceived in terms of the meaningful situations which induce them rather than physiologically. Literature and life are filled with analyses of the emotion-inducing situations. Such situations and men's practical adjustment to them constitute an all-absorbing and universal topic to most persons. When the

outer bodily symptoms of emotion are portrayed apart from their true dynamic, meaningful context, one's ability to recognize, name, and classify them is negligible. As least, the studies we have reviewed indicate this to be so.

Henceforth, students of emotion must recognize that popular conceptions are throughout meaningful, and that there is a vast difference between meaningful statements about emotion and scientific observation of behavioral and physiological events. If we can agree upon an objective, observational, experimental method of approach, we will ultimately agree upon the definition and classification of the emotions. Another point upon which we must concur, in the defining of emotional processes, is the formulation of the relationship between emotional excitement and motivating factors.

Our analysis of the energetics of behavior revealed that there are different levels of activity corresponding to different quantities of energy release. If incentive be added to incentive, the activity level rises, but beyond a certain point disruption occurs. *The foregoing discussion leads us to define emotion as a disruption or disorganization of behavior.* The purest emotions—such as laughing, weeping, extreme general excitement—are those in which there is the most complete loss of cerebral control and the least trace of conscious purpose. During emotional behavior the subject goes wild, his consciousness is a blur, his activity becomes disrupted.

The specific manifestations of emotion naturally vary with the kind of activity in progress when disruption occurs. The following list is intended to illustrate two points: (1) that there are different *degrees* of emotional excitement which vary from the weakest feelings to the intensest emotions, and (2) that there are different *kinds* of emotional disruption. The weak feelings are at the left and the intense emotions at the right.

Weak Feelings		Intense Emotions
Surprise, startle	Fear	Terror
Resentment	Anger	Rage
Fondness	Love	Lust
Envy, jealousy		Intense jealousy
Smiling		Laughing
Sadness	Grief	Weeping, intense grief
Pain	Great pain	Agony
Mild excitement		Intense excitement

The one feature common to all emotional processes is their disorganizing effect upon behavior. The differences among the above-listed emotions are referable to the kind of activity in progress when the disruption occurs.

If this analysis is correct, the task of classifying emotions is really that of classifying the conditions under which disruption occurs, along with the objectively distinguishable kinds of disruption. Right away one thinks of overstimulation, of the thwarting of an impulse, of mental conflict, as the general conditions of emotion; but these conditions give no specific differentiations. To classify emotions one must turn to the motives which are obstructed, as well as to the bodily processes which are manifest. Thus when escape from a dangerous situation is to some degree blocked, fear or terror occurs; when one's purposes are deliberately thwarted by an enemy or when one's self-esteem is lowered through an insult, anger or rage is evoked; when the love-object is out of reach, love, jealousy, or some other emotion such as grief appears, depending upon conditions. Just what specific differentia, if any, can be found among the bodily expressions of the various emotional patterns is a problem for observational study rather than reflection.

Already we have analyzed and classified the basic drives and appetites; nothing is to be gained by doing this again. The only new motivational feature which is added by the present discussion of emotion is that of the disruption or disorganization of behavior under certain conditions of stress. The highest degrees of emotion occur when the most highly motivated behavior is thwarted.

DIFFERENT ASPECTS OF EMOTIONAL ACTIVITY

Any attempt to define emotion and to classify the various emotions meets with a special difficulty. There are distinct scientific points of view which can be taken up towards the study of emotional activity. From one standpoint an emotion is a conscious experience; from another it is a bodily process; from still another it is a pattern of behavior involving the total organism.

Titchener, who held to the standpoint of the experiencing individual, wrote: "An emotion is thus a temporal process, a course of consciousness, and it is also, characteristically, a suddenly initiated consciousness; it begins abruptly, and dies down gradually. It is a

highly complex consciousness, since its stimulus is not an object, a perceptive stimulus, but some total situation or predicament. It is through and through an affective consciousness, since both the situation itself and the organic sensations of the emotive reaction are definitely pleasant or unpleasant. It is an insistently organic consciousness, although the proportion of organic to ideational constituents varies greatly from emotion to emotion and from individual to individual. And, finally, it is always a predetermined consciousness, proceeding in the given case to a natural terminus; although here, too, there is great variability, since the determining tendencies to which the situation appeals may be almost wholly instinctive, or may be partly instinctive and partly acquired."

From the physiological standpoint, an emotion appears to be a widespread bodily arousal in which both striped and smooth muscles are strongly excited and in which the glands and viscera are markedly brought into play. The autonomic discharge causes secretion of sweat, blushing, pallor, erection of the hairs, dilation of pupils, and a variety of other internal bodily processes which Cannon and his collaborators have so well described. Many of the outward bodily expressions of emotion—cries, facial expressions, postural responses, snarling, respiratory changes, and the like—are determined reflexly. It is the task of the physiologist to give a description of these bodily processes.

As distinct from a restricted physiological view, the behavioral aspect takes into the picture the dynamic relations between organism and environment. Watson placed the emphasis upon the stimulus situation which evoked the emotional response. His definition sounds quite physiological: *"An emotion is an hereditary 'pattern-reaction' involving profound changes of the bodily mechanism as a whole, but particularly of the visceral and glandular systems."*

Tolman, a behavioral psychologist, stressed the back-action of organism upon environment. He wrote: "It is not a response, *as such,* nor a stimulus situation, *as such,* that constitutes the behavioral definition of an emotion, but rather the response as affecting or calculated to affect the stimulus situation." Thus anger is an attempt to attack the enemy, pain an impulse to remove the object that injures, love an urge to mate, and so on. This behavioral definition comes quite near to that in terms of the meaningful situation. The

meaningful definitions have thus far failed to give us a unitary psychology of emotion.

One modern view of emotion which has been much discussed is that of McDougall. He combined the conscious and behavioral aspects, by defining an emotion as the consciously felt experience which goes along coincidently with the functioning of some basic instinct or propensity. Thus the emotion of fear is felt when the instinct of flight is aroused; the emotion of anger occurs when the instinct of attack is brought into play; tender emotion goes along with the parental instinct; sexual love (lust) with the sexual instinct.

The voluminous discussion upon the James-Lange theory of emotion is complicated by the existence of these points of view. Is the emotion a conscious experience? or a physiological response? or a bit of behavior? James assumed the emotion to be a conscious organic experience which followed the peripheral bodily changes, whereas the classical theory had presupposed that the conscious emotion occurred first and that this caused the bodily changes. The question of causation when restated in terms of temporal sequence still involves the problem of relationship between two events experienced from different standpoints.

Since so many points of view can be taken towards emotional excitement, it is not surprising that writers disagree. Distinctions drawn from one standpoint sometimes do not appear from others. For example, the grouping of emotions with respect to their pleasantness or unpleasantness is readily made and highly significant from the standpoint of the experiencing individual, but this distinction does not even exist in a strictly objective psychology. Again, from the standpoint of behavior, the essential element in fear is the escape from danger; in anger it is the attack upon an enemy; in general excitement, it is a disturbance with no particular purpose. The physiologist who ignores the behavioral aspect of emotion has up to the present time been unable to distinguish among fear, anger, and general excitement, on the basis of their internal bodily processes. This means, as stated above, that distinctions which can be clearly drawn from one point of view may not appear when the standpoint is shifted.

The writer holds to the multiple-aspect hypothesis which postu-

lates that emotional processes simply exist in nature, just as they have existed for countless ages, regardless of the ways in which men of science describe and interpret them. These emotional processes appear now in one light, now in another, according to the assumption made by the observer, his problem, interest, or point of view. Some of the more important aspects of emotional reaction are the following:

1. The *environmental situation* which induces emotion (objectively the physical environment, subjectively the individual's field of experience).
2. The *behavior* of the organism in response to the situation (objectively physical movement, subjectively the experience of acting).
3. The *physiological changes* of emotional excitement.
   (*a*) The appearance of these bodily changes to an outside observer, or the "expressions" of emotion.
   (*b*) The internal physiological processes of emotional upset.
4. The *conscious experience* of the emotionally excited individual.

Many contemporary psychologists hold to a single point of view —behavioral, existential, *Gestalt,* purposive, etc. This has the advantage of simplifying and clarifying the field of psychology, but it has the disadvantage of partially eclipsing the relevant facts. The above aspects are mutually supplementary. Familiarity with all of them is needed for a complete understanding of the nature of human and animal emotion. All the diverse facts of observation and of felt individual experience must be fitted into a common picture of emotional excitement, and psychological principles discovered which have a general validity. At the present day this is easier said than done.

THE PHYSIOLOGY OF EMOTION

A study of the physiology of emotion must take account of the bodily changes which are known to occur during emotional excitement. Some of the more obvious ones are listed below:

1. *Reflex changes in the skeletal musculature.* In the cat, for example, anger involves baring the teeth, snarling, attacking the enemy; fear involves arching the back, spitting, running, tree-climbing, and other defensive activities. In this group of changes are the facial expressions and vocalizations so apparent in human emotion. Cry-

ing and wailing constitute one pattern of muscular change; smiling and laughing, another; surprise and astonishment, still another. In joy there is a rising tonicity of the entire musculature including the face; in grief, a lowering of tonicity; in surprise and astonishment, an inhibition of the innervation of particular groups of facial muscles, especially the masseters and the orbicular muscles of the eyes.

2. *Reflex changes in the activity of peripheral glands and smooth muscles.* A symptom of grief is the flow of tears; a mark of fear is the inhibition of salivary secretion. During almost all emotional excitements the secretion of the sweat glands is accelerated. This can be shown by passing a weak electric current through the body and through a galvanometer. Since sweat is moist and slightly saline the electrical resistance of the skin is lowered by an increase in the quantity secreted. These variations of bodily resistance can be detected readily by the galvanometer. The galvanic response is specific to the secretion of sweat, and hence is a useful index of feelings and emotions. In addition to glandular responses are the peripheral changes of smooth muscles, made manifest by such processes as the constriction of the pupils, erection of the hair, and changes of the blood vessels noted below.

3. *Vascular changes.* The blush of shame indicates a dilation of the superficial blood vessels; the pallor of fear, a constriction. When a man is confronted with grave danger the heart beats strongly and quickly, accelerating the circulation and increasing the supply of blood to the muscles. A common symptom of emotional excitement is an increase of blood pressure.

4. *Disturbance of respiration.* In surprise, breathing is temporarily checked; in laughing and weeping it is spasmodic; in other emotions it is quickened or retarded, made deeper or shallower.

5. *Secretion of ductless glands.* The clearest example of glandular secretion during emotional excitement is found in the activity of the adrenal glands during the emergency reaction. Cannon has shown that adrenal secretion energizes the organism in times of emergency and stress. Some of the physiological effects of adrenin are: causing the liver to pour out glycogen into the blood, which brings an increase of muscular strength; quickly counteracting the effects of fatigue; hastening the coagulation time of the blood which prevents undue bleeding if injury occurs; producing chemically the effects also brought about through excitation of the sympathetic nervous system.

6. *Chemical changes.* In addition to the effects of glandular secretion there are other chemical changes which, as yet, have not been much studied in relation to emotional excitement. The oxygen content of the blood increases during fear and anger; emotion produces variations in the acidity of blood and saliva.

7. *Internal bodily changes.* An example is the inhibition of gastric secretion and the digestive process with the elimination of hunger during fear, anger, and strong general excitement.

The Neural Basis of Conscious Emotion. It is generally assumed by physiological psychologists that all conscious experiences including emotions depend upon neural excitations in the cerebral cortex. Head and Holmes, however, have attributed a kind of primitive consciousness to the functioning of the thalamus.

Cannon believes that the thalamus is a basic coordinating center for the emotional patterns of reaction, but not a center of emotional consciousness. Regarding this point he writes:

> Within and near the thalamus the neurones concerned in an emotional expression lie close to the relay in the sensory path from the periphery to cortex. We may assume that when these neurones discharge in a particular combination, they do not only innervate muscles and viscera but also excite afferent paths to the cortex by direct connection or by irradiation. The theory which naturally presents itself is that *the peculiar quality of the emotion is added to simple sensation when the thalamic processes are aroused.*

According to Cannon's theory (which also was developed independently by Dana) afferent impulses are discharged from the thalamus to the cerebral cortex and at the same time motor impulses are discharged downward to produce the visceral and somatic changes of emotion. The afferent impulses from the thalamus to the cortex are assumed by Cannon to determine the conscious emotion.

The neural organization in the thalamus and in centers below it is biologically older and more primitive than that of the cerebral cortex. These ancient neural structures regulate the basic vegetative processes and the reflexes of locomotion. There is considerable experimental and clinical evidence that the neural organization in the region of the optic thalamus is concerned with the reflex patterns of emotional reaction. Here are some pertinent facts.

When the cerebral hemispheres of cats and dogs are surgically

removed these animals display exaggerated emotional behavior. Noxious stimuli cause the decerebrate cats to snarl, and the dogs to whine, show their teeth, and bark. The skeletal reflexes of emotion are intensified and their threshold lowered by removal of the cerebral hemispheres.

The cerebrum normally inhibits the activity of the lower centers. It acts as an organizer or coordinator of the most primitive behavioral patterns—holding them in check, redirecting, integrating these archaic activities. When for any reason the cerebral control is relinquished the lower coordinating centers take charge and emotional patterns of behavior appear. With human subjects conditions which reduce or temporarily abolish cortical control of behavior result in a marked emotional display. Anesthesia which for the time removes cortical control often is accompanied by displays of laughter, rage, grief. Nitrous oxide (laughing gas) makes the subject laugh or weep while quite unaware of what he is doing. Acute alcoholism depresses the higher brain centers; we all know that it facilitates emotional behavior.

Whenever a lesion interrupts the motor tract between cortex and thalamus, as in certain forms of hemiplegia, the patient is incapable of moving his face on the paralyzed side, yet in sudden emotional outbursts of joy or sorrow both sides of the face involuntarily react. This shows that muscles which are unresponsive to voluntary control spring reflexly into action while expressing emotion. With such patients, pin pricks, painful pressure, heat or cold, produce signs of distress which are localized on the damaged side more definitely than on the well; agreeable stimulations are also said to be felt more keenly on the damaged side. In "pseudo-bulbar-palsy," patients having no voluntary control over the facial muscles nevertheless exhibit fits of uncontrolled laughing and crying. These clinical facts clearly indicate that the primitive skeletal reflexes of emotional expression have their coordinating centers below the level of the cerebrum; they support Cannon's hypothesis of thalamic centers of coordination for the reflexes of emotion.

The main rôle of the cerebral cortex in emotional excitement is to function in observing and analyzing the environmental situations which cause the response. Through cerebral processes one becomes aware of a dangerous situation, one hears and understands

the insulting remark, one recognizes the lover of many years, one observes the event which brings laughter or weeping. In civilized groups the cerebrum serves, as we have noted, to inhibit the primitive emotional reflexes; but when overstimulation, thwarting, or conflict causes the individual to "lose his head" the cerebral inhibition is weakened or eliminated for the time. This results in an emotional display.

A secondary rôle of the cerebrum in emotional excitement is to give the subject an awareness of the bodily changes which are taking place. One feels the pounding heart, the heaving chest, the cold sweat, and other peripheral changes when one attends to these bodily processes. The awareness of the peripheral changes is a prominent factor in the conscious emotion, as James pointed out. In the stress of emotional activity one does not ordinarily attend to bodily changes; even severe injuries may go unnoticed. One gets the impression of a general organic disturbance without analyzing it into specific parts.

The Function of the Autonomic Nervous System During Normal and Emotional States. The peripheral glands and smooth muscles which are so markedly affected during emotional excitement are brought into function by impulses across fibers of the autonomic nervous system. Also the internal changes of emotion are regulated in a similar way. The structures which are excited by impulses from the autonomic nervous system are represented schematically at the right of Fig. 82. These structures are readily recognized as the ones which function during emotional excitement.

The autonomic nervous system has three main divisions: cranial; thoraco-lumbar or sympathetic; sacral. The cranial and sacral divisions together are sometimes called the parasympathetic; these two divisions are antagonistic in function to the sympathetic. The autonomic nervous system comprises a series of ganglia which receive neural excitations from the central nervous system over preganglionic fibers (shown in dotted lines) and which transmit excitations to smooth muscles and glands over the postganglionic fibers (solid lines).

The fibers of the sympathetic division differ from those of the cranial and sacral divisions in their wide distribution throughout

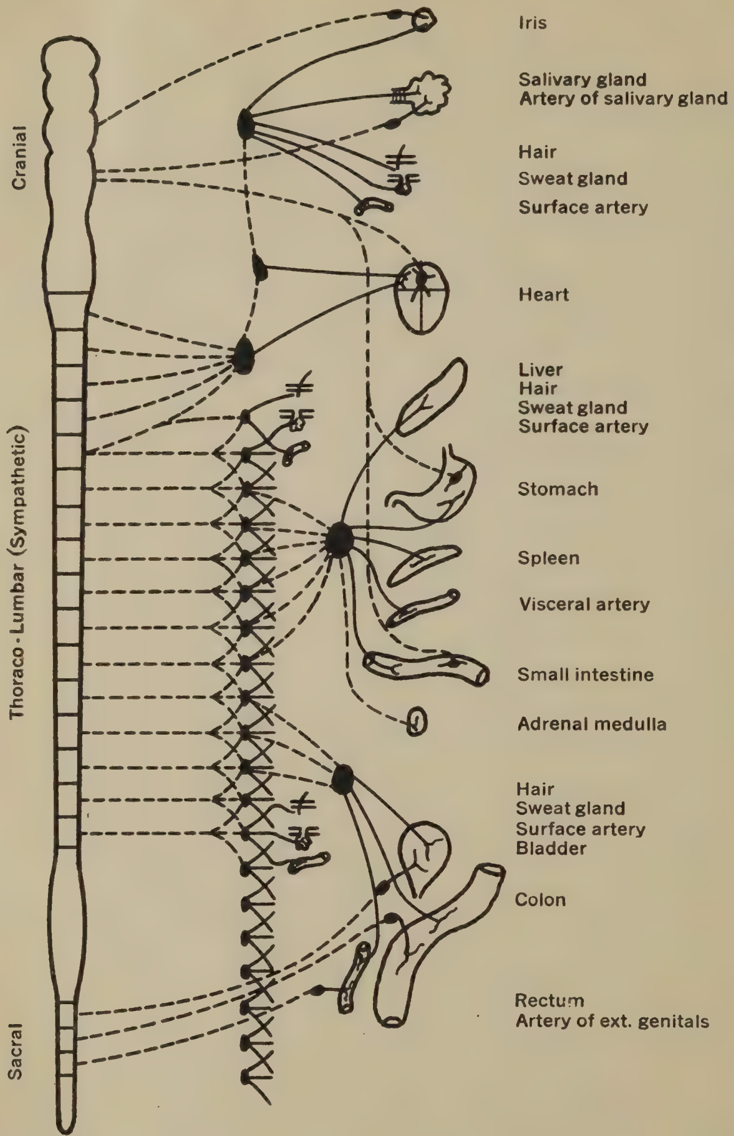

Fig. 82. Diagram of the General Arrangement of the Autonomic Nervous System. (*After Bard, and Cannon.*)

The explanation is in the text.

the body. They go to the ciliary muscle of the eye, where they dilate the pupil. They go to the heart, where they accelerate its beating. They go to the arteries and arterioles of the skin, abdominal viscera, and other parts, where they keep the smooth muscles of the blood vessels in a state of tone or slight contraction; in emotional reaction they increase the tone through a special discharge of impulses, thus raising the arterial blood pressure. They are distributed to the smooth muscles attached to hair cells and in times of emotional excitement may cause these muscles to contract and the hairs to stand erect. They go to the sweat glands and cause them to pour out sweat. They go to the gastro-intestinal canal along its entire length and in pain and strong emotion inhibit the entire digestive process. They innervate the genito-urinary tracts, causing the smooth muscle of the internal genital organs to contract and the bladder generally to dilate. They pass to the liver, where in times of emotional stress they cause sugar (glycogen) to be released into the blood, thus giving a source of energy for prolonged muscular activity.

The fibers of the cranial and sacral divisions of the autonomic have, by contrast, a more restricted distribution. The third cranial nerves send excitations only to the smooth muscles in front of the eyes. The vagus nerves distribute impulses to the lungs, heart, stomach, and small intestine. The postganglionic fibers of the heart, stomach, and small intestine are imbedded within the organs themselves (Fig. 82). In the sacral division the preganglionic fibers lead from the spinal cord to ganglia in close proximity to the distal colon, bladder, and external genitals. The arrangement of having the ganglion near to the structure excited assures a specificity of action. In addition to the above the cranial and sacral divisions supply nerves to individual blood vessels which relax or dilate them.

During normal, non-emotional activity the autonomic nervous system regulates the primitive vegetative functions of the body, so essential to the continued existence of the individual and the race: the process of digestion, the storing of essential food materials, the glandular secretions which dominate growth and metabolism, the processes of elimination and reproduction. According to Kempf, the autonomic nervous system is disturbed or forced into a state of unrest by metabolic conditions and persistent stimuli originating within or without the body. We must learn to see the living body as a complex unity motivated by tensions which originate in

the stomach, intestines, rectum, liver, salivary glands, bladder, diaphragm, heart, lungs, prostate, external genitals, kidney, and other organs. These tensions develop independently at different times and with varying periodicities.

According to Kempf, the autonomic system is biologically older than the cerebrospinal system, and dominates it. In the embryo the autonomic is comparatively well organized before the cerebrospinal system; it begins its domination of behavior well before birth. When a tension exists in the autonomic system the cerebrospinal system is compelled to make the adjustments which are necessary to neutralize the disturbance. Even the tonus of skeletal muscles is dependent upon the autonomic tensions. Kempf writes: "The posture of the ambling, lolling, lazy, indifferent man is in marked contradistinction to the tense, erect, stiff figure of the sensitive, proud, ambitious, striving man. The feelings of muscular weakness and loss of muscle tone in the fearful, and the firm muscle tone and feelings of power in the confident are further examples.

"The aggressive pose of anger, the timid retractiveness of fear, the spontaneity and exuberance of joy, the retarded movements of depression, the relaxation of indifference, the set of attentiveness are further illustrations of the postural tonus of the skeletal muscles as determined by the autonomic-affective state."

Now regardless of what one thinks about Kempf's theory of normal autonomic function, it is certainly true that during periods of emotional excitement the autonomic nervous system is brought into function to a marked degree. The changes in glandular secretion and muscular tonus which take place in emotional excitement are brought about through a discharge across the autonomic nerves.

One important principle in the functioning of the autonomic nervous system is the antagonism which exists between the thoraco-lumbar division and the other two divisions. Many of the structures which are innervated by the thoraco-lumbar division are also innervated by the cranial or the sacral divisions. Cannon has shown that, *"When the mid-part (sympathetic) meets either end-part (cranial or sacral) in any viscus their effects are characteristically antagonistic."* Thus the sympathetic dilates the pupil of the eye, and the cranial constricts it. The sympathetic accelerates the beat of the heart, and the cranial retards it. The sympathetic relaxes

the lower part of the large intestine and the sacral contracts it. The sympathetic contracts the exit from the bladder and the sacral relaxes it. This antagonism between the sympathetic and the other two divisions suggests a similar relationship in the neural innervation of the paired skeletal muscles which Sherrington called "reciprocal innervation." When a flexor muscle contracts its antagonistic extensor actively relaxes, giving smooth coordinated movement.

The opposition between the sympathetic and the other two divisions of the autonomic nervous system explains the incompatibility which exists between particular affective reactions. Under normal conditions excitations across the cranial fibers facilitate the digestive process, but during fear and rage, when there is a discharge over the sympathetic, digestion is inhibited. Again, sexual emotion, which depends upon the excitation of the sacral nerves, is blocked by sympathetic excitation in conditions of anger and fear.

In biological emergencies, necessitating a fight or a flight to preserve life, in bodily injury, in extreme hunger, asphyxia, and other desperately vital conditions there is a diffuse discharge across the sympathetic fibers. The sympathetic division acts as a unit producing effects widely distributed through the body. These effects all prepare the organism for vigorous action; they mobilize the energy reserves.

The cranial division regulates a number of conserving functions. It narrows the pupil, shielding the retina from intense light. It slows the heart rate, giving the cardiac muscle a longer rest period for recuperation. It regulates the flow of saliva and gastric juice and the tone of the alimentary tract. In these ways it is essential to the processes of digestion and absorption of food materials. Cannon has called the cranial division a "conserver of bodily resources."

The sacral division regulates the mechanisms of elimination. The pelvic nerves contain fibers which cause the contraction of the colon, rectum, and bladder, and fibers which dilate the external genitals. The *nervi erigentes* bring about engorgement of erectile tissue of the external genitals but have no effect upon the internal genitals. The vasa deferentia and seminal vesicles of the male and the uterus of the female are supplied by lumbar branches of the sympathetic only, which branches also constrict the blood vessels of the external genitals in opposition to the *nervi erigentes*.

Cannon has described the sacral division as a "group of mecha-

nisms for emptying." In strong emotional reactions there is sometimes a simultaneous discharge across both the sympathetic and the sacral divisions. The involuntary voiding of the bladder and colon in times of great emotional stress are accounted for in this way.

The functional interrelations within the autonomic have been described by Cannon in the following words: "By means of the general diffuse action of the sympathetic, and the opposite particular action of the parts of the cranial and sacral autonomic supply, every variety of change is provided for. All the viscera can be affected simultaneously in one way or the other through increased or decreased tone of the sympathetic division. And any special organ can be separately affected one way or the other through increased or decreased tone in the special nerve of the opposed cranial or sacral division that is supplied directly to that organ. The sympathetic is like the soft and loud pedals, modulating all the notes together; the cranial and sacral autonomic are like the separate keys."

The autonomic nervous system is made up entirely of motor or *efferent* nerves. It carries excitations from the central nervous system out to the organs and parts shown at the right of Fig. 82. There are, however, afferent fibers in nerves of this system, but these fibers are technically classified as belonging to the cerebrospinal rather than the autonomic system, *i.e.,* the cell bodies of these afferent fibers are in the sensory ganglia of the cranial and spinal nerves.

The Utility of Internal Bodily Changes During the Emergency Reaction. A diffuse discharge across the sympathetic division of the autonomic nervous system evokes profound bodily changes which energize the organism and in other ways prepare it for prolonged and vigorous action such as combat or flight. It is interesting that the secretion of adrenin into the blood brings about and sustains the same bodily processes chemically.

The processes regulated by the cranial and sacral divisions, by contrast, have no unitary function but rather a variety of particular functions. There is no hormone for the cranial and sacral divisions which acts as does adrenin for the sympathetic. A hormone which would evoke simultaneously all the changes brought about by the cranial or the sacral division would be disorganizing. There is no biological need for such action.

When the sympathetic is brought into function the resulting bodily changes energize the organism to meet an emergency or time of stress. Cannon has summarized his view as follows: "Every one of the visceral changes that have been noted—the cessation of processes in the alimentary canal (thus freeing the energy supply for other parts); the shifting of blood from the abdominal organs to the organs immediately essential to muscular exertion; the increased vigor of contraction of the heart; the discharge of extra blood corpuscles from the spleen; the deeper respiration; the dilation of the bronchioles; the quick abolition of the effects of muscular fatigue; the mobilizing of sugar in the circulation—these changes are *directly serviceable in making the organism more effective in violent display of energy which fear or rage or pain may involve*."

The work of Cannon extends the Darwinian principle of utility from the outer responses of emotion to the glandular and visceral changes of emotional reaction. According to our view the sympathetic-adrenal reaction is an energizing, motivating response, but not necessarily an emotional one. It is emotional only when there is disruption of behavior; but in emergency situations with a high degree of energy release disruption is exceedingly probable.

THE RÔLE OF EMOTIONAL REACTIONS IN BEHAVIOR

It is said of Lincoln that during the war a lady belonging to a prominent Kentucky family visited Washington to beg for her son's pardon. At the time the son was in prison under sentence of death for belonging to a band of guerrillas which had committed many murders and outrages. With the mother was her daughter, an accomplished musician.

> There were probably extenuating circumstances in favor of the young Rebel prisoner, and while the President seemed to be deeply pondering, the young lady moved to a piano near by, and taking a seat, commenced to sing "gentle Annie," a very sweet and pathetic ballad, which, before the war, was a familiar song in almost every household in the Union. . . . It is to be presumed the young lady sang the song with . . . plaintiveness and effect. . . . During its rendition, he [Lincoln] arose from his seat, crossed the room to a window in the westward, through which he gazed for several minutes with that "sad, faraway look," which has so often been

noted as one of his peculiarities. His memory, no doubt, went back to the days of his humble life on the banks of the Sangamon, and . . . a picture of the "gentle Annie" of his youth, whose spirit then, perhaps, guided him to the side of mercy. Be that as it may, Mr. Lincoln drew a large red silk handkerchief from his coat-pocket, with which he wiped his face vigorously. Then he turned, advanced quickly to his desk, wrote a brief note, which he handed to the lady, and informed her it was the pardon she sought.

Literature and life are filled with illustrations of emotional appeals which are effective in getting action. The public speaker, the preacher, or revivalist by arousing emotion regulates and directs behavior. Propaganda is another case in point.

In an interesting discussion of the motivational factor in propaganda, Strong writes: "The detailed suffering of a little girl and her kitten can motivate our hatred against the Germans, arouse our sympathy for the Armenians, make us enthusiastic for the Red Cross, or lead us to give money for support of a home for cats. The story may be true or concocted for the purpose; the inferences against the Germans or for the home for cats may also be true or false; the organization carrying on the propaganda may be efficiently administered or not—all these considerations little concern us. We feel the emotion, we want to do something because by acting we feel better, and away we go regardless of mere intellectual considerations."

In all such cases the prevailing view is that we get action by arousing emotion. The popular view raises the interesting question of the relationship which exists between overt action and emotion. To this question we will come back later.

After-Effects of Emotional Reactions. If fear, love, terror, grief, laughter, or other emotion is aroused only once in a given situation, a return to that situation or even a recall of it in thought is likely to bring back the emotion in an unmistakable fashion. Although almost everyone can think of illustrations of this principle in his own experience, a few examples are given below.

A boy of three and a half years was taken by his mother to a religious revival at which was sung the emotional song, "Where is my wandering boy tonight?" He was greatly impressed and continued to talk about the song when he went to bed, asking ques-

tions about it. With tears in his eyes he said that he would never go off with bad boys and leave mama, and that mama must never go off with bad ladies and leave him, and that daddy must not go away with bad men, and sister with bad girls. Since this incident, when he is rather naughty his father starts to sing in a melancholy voice, "Where is my wandering boy tonight?" The song has a quieting effect upon him.

The writer recalls that as a small boy he once heard a gun go off under his bedroom window. This happened just as the lights were being turned out for the night. The maid became frightened, saying that someone had probably been killed. Men were heard running down the street. For many years after this incident an uncontrollable fear appeared whenever it was necessary to raise the curtain and open that window before turning out the lights. Although the fear persisted for years, nothing was said about it to brothers and parents. It was the moving to another house that ultimately brought the fear to a close by removing the stimulating situation.

The following further examples are quoted from Kempf:

A two-year-old boy was learning to play with fireflies through the influence of an adult. For him all insects of the firefly size were like fireflies. One day he caught a bee. It stung him in the finger and since then he will not go near a bee and touches fireflies very gingerly. If the bee experience had been the first experience with insects all insects would have been potential bees for some time (causes of pain), and fireflies would probably not have been handled until numerous pleasure experiences with other very different insects had been acquired.

A young girl (about six) was in a carriage crossing a track, when the horse, driven by an older girl, became frightened at the approach of a train. A horrible catastrophe was barely averted, and since then this girl (now fifteen) still feels uncomfortable reactions when she recalls the experience, when she passes this railroad crossing, and is very uncomfortable in carriages without a well-trusted driver.

In the above examples a single emotional reaction left its indelible trace upon the personality. Non-emotional activities, by contrast, such as repeating a multiplication table, giving Latin equivalents

for English words, and playing the scale of B-major, require a number of repetitions to learn and are readily lost unless frequently reviewed.

Feelings and Emotions in Relation to Verbal Organization. Words recall not only visual, auditory, and non-verbal images, but also past experiences which are loaded with feeling and emotion. Some words such as "pain," "dirt," "sin," and "sadness" are associated with unpleasant experiences; others like "fun," "gay," "cheerful," and "happy" recall pleasant experiences. Thousands of emotional reactions, weak and strong, are associated with the words which designate or describe them and their inducing situations. Thus, a spoken word can bring back a fear, love, loathing, grief, hatred, etc.

In a carefully controlled experiment, Darrow has shown that changes in blood pressure and in the secretion of sweat which have been evoked by emotionally loaded words were distinguishable from the responses called out by simple sensory stimulations, such as a shout, a slap on the face, gunfire. Disturbing words, such as "constipation," "guts," "masturbation," "divorce," "kiss," were controlled by indifferent words, as "dog," "pencil," "apple," "ice." Both the sensory stimulation and the ideational presentations induced marked bodily responses. The sensory stimuli were relatively more effective in producing vasoconstriction and increase of perspiration (shown by the galvanic skin-reflex); the ideational presentations were relatively more effective in increasing cardiac activity as indicated by blood pressure and pulse rate.

Darrow pointed out that the term "emotion" has been commonly employed to designate two distinguishable bodily processes: the immediate reflex response to sensory excitations, and the response which is mediated by disturbing associations. The difference which Darrow found can doubtless be explained by reference to the neural mechanisms excited by the two kinds of presentation. The sensory stimulations produce their bodily effects reflexly through centers in the thalamus or other subcortical regions, whereas the disturbing words evoke their emotional responses by way of cerebral excitation.

Another study which deals with affectively loaded words is Cason's work upon annoyances. Certain words and topics of conversa-

tion, Cason found, were especially unpleasant. Concerning these disagreeable words he writes:

> In the minds of women especially, *sex* is associated with immorality, brutality, misery, venereal disease, and pain. It is always a dangerous subject for discussion especially in a puritanical country. Many of those suffering from psychoneuroses and psychoses are at the same time abnormal and peculiar in the matter of sex; but the peculiarities of sex can be results as well as causes of the abnormal mental conditions.
>
> *Sin* is associated with unpleasant childhood and adolescent struggles over moral and religious problems, with unsuccessful attempts to free one's self from the sinful or supposedly sinful modes of behavior, and with feelings of shame, personal depravity, and inferiority. The concept of sin is particularly important in some deluded and neurotic individuals. Melancholic and depressed patients may greatly exaggerate the shameful nature of their thoughts and acts and sometimes think that they have committed what they somewhat vaguely describe as the "unpardonable sin."
>
> *Dirt* is associated with carelessness in personal appearance, with unsanitary living conditions, and with the soiled, spotted, and unclean character of people. Most dirt, however, is not harmful in itself. Cleanliness is one of the greatest burdens of the present civilization, and high pressure methods are used to make all people conform to the exacting standards. People who are suffering from an inner feeling of guilt or shame may have a morbid fear of dirt (misophobia); and they may try to present a spotless front to themselves and to the world. Removing dirt from the body may be symbolical of freeing the personality from sin, as in the case of Lady Macbeth who kept on washing her hands in trying to remove the guilt of killing the king.
>
> *Germs* are associated with contamination, illness, and disease. Most germs actually die on brief exposure, and the great majority of them are not at all harmful. The popular literature on medicine, the quack doctors, and the patent medicine advertisements have combined to exaggerate the importance of bacteria as causes of disease, and as a result many people live in morbid fear of infection. It not infrequently happens that a malady is diagnosed as an "infection" when the actual cause is unknown.

These matters of sex, sin, dirt and germs exert an important and peculiar influence on our likes and dislikes. Purity leagues and

many other social agencies misrepresent and exaggerate the evils of sex. Most of the orthodox religions paint such a dark picture of sin that it is often regarded as a gruesome and morbid subject. The strongest support for the war on dirt has come from the commercial enterprises which advertise and sell various cleansing agencies. Business enterprise and the quack medical literature have fostered an exaggerated fear of the invisible microbe.

There are certain other topics that are unpleasant to a large number of people as a result of their past associations, such as *illness and disease; quarreling and fighting; economic poverty; problems related to the relative rights and duties of men and women; intoxicants; and religion.* The unpleasant past experiences which are related to these subjects and behavior patterns are sometimes dismissed or excluded from conscious memory and live on only in the unconscious; but various stimuli and situations are still able to arouse the old feelings of annoyance and aversion. It is a common experience to become vexed or exasperated over a certain subject without having a clear understanding of the basic psychological factors. It would be expected therefore that the average person would not completely realize the importance of this principle of unpleasant association in the motivation of conduct.

Words are highly important in the building-up of feelings and emotions, in the control of mental set and hence of behavior. Certain "loaded" words are also important as releasers of energy, as William James noted in the following statement:

> . . . there are common lines along which men simply as men tend to be inflammable by ideas. As certain objects naturally awaken love, anger, or cupidity, so certain ideas naturally awaken the energies of loyalty, courage, endurance, or devotion. When these ideas are effective in an individual's life, their effect is often very great indeed. They may transfigure it, unlocking innumerable powers which, but for the idea, would never have come into play. "Fatherland," "the Flag," "the Union," "Holy Church," "the Monroe Doctrine," "Truth," "Science," "Liberty," Garibaldi's phrase, "Rome or Death," etc. are so many examples of energy-releasing ideas. The social nature of such phrases is an essential factor of their dynamic power. They are forces of detent in situations in which no other force produces equivalent effects, and each is a force of detent only in a specific group of men.

The Doctrine of Sentiment. An individual builds up within himself systems of mental organization which predispose him to *feel* in a particular way. The recognition of this fact is an essential feature of the Shand-McDougall doctrine of sentiment.

It has been pointed out by Shand and McDougall that emotional dispositions tend to become organized around various objects and classes of objects. If, to take a single example, a man has to accept rudeness and insult from a superior officer, employer, etc., and to suppress repeatedly the normal anger-attack pattern, a stable disposition of hate develops towards the offender. To such an acquired disposition, organized around some central object or recurrent situation, the name "sentiment" has been applied. This usage agrees quite closely with popular speech, which refers to sentiments of patriotism in the presence of the flag, sentiments of love toward friends and of hate toward enemies.

One outstanding characteristic of a sentiment is that it predisposes the individual to react *towards* or *away from* something. In this respect a sentiment is an attitude. Like attitudes, sentiments can be paired in the following way:

Positive	Negative
Love	Hate
Anger	Fear
Self-assertion	Humility

Although in each case there is a positive and a corresponding negative pattern, it would obscure the true structure of sentiments to speak as if all positive responses were alike. In fact, the liking for a person may be based upon sexual love, recognition of ability, common interest, or upon some other basis. Similarly, disliking may rest upon fear, anger, disgust, or upon something else.

So far as fundamentals are concerned a sentiment is a mental structure which regulates both behavior and conscious feeling. The only difference between the conception of sentiment and the broad view of attitude is that the former places greater emphasis upon the conscious feeling of the individual. It is doubtful whether psychology needs to retain both the conceptions of attitude and of sentiment.

CONCLUDING STATEMENT

There are certain highly motivated forms of behavior such as fleeing to save one's life, fighting to protect one's self or family, copulating when sexually aroused, striving vigorously to win a foot race or to gain a money prize, etc. In all such cases behavior is well integrated; skeletal muscles and viscera cooperate in efforts to achieve the goal.

These highly motivated, goal-directed activities should be distinguished from the organic state of emotional disruption. The latter is not a direct factor in motivation but rather an outer symptom of the blocking or thwarting of motives, or perhaps of an overexcited, overmotivated state of the organism. When emotion occurs there is an imbalance of motives, which appears outwardly as weeping, laughing, writhing in agony, trembling in fear, raving with rage, etc. The pattern of emotional expression depends upon the kind of motivation which is thwarted and upon the nature of the inducing situation. An emotional response is significant to the individual himself as well as to others in that it indicates the existence of motivational imbalance.

There are all degrees of disorganization within behavior from a wholly calm, non-emotional state to a condition of complete emotional breakdown and disruption. The psychologist can distinguish all gradations from the weak affective response which is not at all disruptive to the intense emotion.

Emotional reactions leave a trace upon the nervous system such that they may later be reenacted. Recall of past situations which involve conflict, thwarting, or overexcitation redintegrates the emotional phase of the response along with the non-emotional.

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CHAPTER X

THE DYNAMIC INTERPLAY OF MOTIVES

> "Conflict, with its emotional tension and accompanying indecision and paralysis of action, cannot persist indefinitely; it is a biological necessity that some solution of the difficulty, some way out of the *impasse*, should be found."
>
> —BERNARD HART

Life abounds with homely examples of the dynamic interplay of motivating factors. Mrs. *X*, while suffering from a mild headache, declines the invitation to a tea given by the inconspicuous Mrs. Poorman, yet a week later when invited to a reception held by the socially prominent Mrs. Richhusband she rallies from a more severe headache sufficiently to attend. Similarly, Johnny's toothache keeps him home from school, but when the boys whistle for him to come out and play ball his pain rapidly disappears. Again, Alice, who has early shown a liking for drawing, does not find in the approbation of her elders sufficient incentive for the tedious task of daily practice required by her music teacher. Yet when her mother offers drawing lessons on the condition that she will keep practicing regularly, the interest in music greatly increases. Countless similar instances could be given to show how human behavior varies with this or that shifting circumstance.

THE CONFLICT OF DETERMINATIONS

Conflict is one of those basic realities of nature which exists regardless of the point of view from which it is studied. The biologist finds it; the physiologist is familiar with the conflict of responses; the student of behavior observes it repeatedly. The psychoanalyst makes much of it. The novelist, the playwright, base their stories upon it. The man of the world knows about mental conflicts at first hand.

To the student of motivation the analysis of conflict is a fasci-

nating task. If we are going to understand mental conflict and the individual's adjustments to situations which thwart, we must first be informed about the motives and incentives which act as spurs and checks to behavior. In the foregoing chapters the fundamental determiners and regulators of behavior have been investigated. It now remains to examine the dynamic interplay of these motivating factors.

The Physical and Physiological Basis of Conflict. In the last analysis, conflict rests upon the mechanical impossibility of moving in opposite directions at the same time. An animal does not at once move toward food and away from it; nor does it swallow and vomit simultaneously; nor like and dislike one and the same presentation in a single response. A hungry animal does not eat food and run away from danger at the same time; nor does a sexually aroused animal copulate and fight an enemy simultaneously. Some patterns of behavior are completely antagonistic, incompatible. Washburn has put it this way: "Now while it is perfectly possible for antagonistic muscles to contract at the same time, . . . it is clearly impossible for a limb, or any part of the body, to be *actually moved in opposite directions at the same time*. It is not possible for the arm actually to move up and down at the same time; or for the hand to draw a circle from left to right and from right to left at the same time, or for the muscles of articulation to pronounce *p* and *o* at the same time, since the former involves closing and the latter opening the lips. The reason why such movements cannot be simultaneously performed is not merely because they involve antagonistic muscles, but because, if a member could be moved in two opposite directions at the same time, the muscle moving it in one direction would have to be at once more strongly and less strongly innervated than its antagonist: the thing is logically an impossibility. We shall use the term 'incompatible movements' to designate movements that cannot be performed together."

Incompatible movements are found on the level of reflex behavior. For example, when a dog is walking quietly along a path the pressure of the animal's weight upon the right hind foot reflexly brings the backward thrust which propels the animal; this thrust of the leg is one phase of the well-integrated pattern of

locomotion. If, while the dog is walking, a flea should bite his shoulder, the walking would have to be interrupted for the leg to make a series of scratching movements. Now scratching movements comprise a well-integrated reflex pattern which is clearly incompatible with the walking sequence. The hind leg of the dog cannot at the same time be employed in scratching the shoulder and in walking. Although it would be biologically useful to have the skin scratched while the animal still continues walking, this is mechanically impossible. Everywhere biological evolution has been restricted by physical necessity.

Incompatible movements have been described by Sherrington in his discussion of the spinal reflexes. If, for example, the skin on the shoulder of a spinal animal is stimulated, the scratch-reflex is elicited. But suppose that while scratching is in progress a stimulus is applied to the foot on the opposite side, a stimulus so intense that it threatens to damage the skin. In this event the scratching ceases instantly and the stimulated foot is drawn away from the painful stimulation; there is a steadily maintained contraction of the flexors of ankle, knee, and hip. The type-reflex of scratching with the right hind leg and that of flexing the left hind leg are physiologically, but not mechanically, antagonistic. The biological explanation of this physiological antagonism is easy to discover: if a normal dog received a painful stimulus on the left hind foot, that foot would be quickly withdrawn as the weight of the animal shifted to the right hind foot. The postural change would necessitate a cessation of scratching movements. The neural arcs which determine this antagonism of behavior patterns in the normal subject remain unchanged in spinal animals.

Sherrington also found that the extensor-thrust and the scratch-reflex are antagonistic when the stimulations inducing the responses are both on the *same* side of the body. If, while evoking the scratch-reflex by stimulating the skin of the shoulder, the plantar surface of the hind foot on the *same* side is excited, scratching movements are at once arrested.

Distinct from antagonistic reflexes are others which Sherrington called "allied." The following case illustrates allied reflexes. If, while the scratch-reflex is being elicited from stimulation of a skin point on the shoulder, a second point about 10 centimeters distant

is excited, this added stimulation facilitates, *i.e.,* augments, the scratching response. This can best be demonstrated by using subminimal stimuli at both points. Although neither stimulus alone is able to evoke the response, the two applied simultaneously do so. The phenomenon cannot be explained as a peripheral effect, Sherrington proves, but only in terms of neural reinforcement within the spinal cord.

The arcs of the cord are so arranged that different type-reflexes utilize the same "final common path" to the muscles. In the case of antagonistic type-reflexes, such as scratching and walking, the same final common path is used either by the one or by the other but not by both at the same time. In the case of allied reflexes the same final common path is employed simultaneously with a summation effect. In the principle of exclusive use of the "final common path" by one reflex at a time, there is a physiological equivalent of the mechanical impossibility of moving simultaneously in opposite directions.

The same kind of antagonism exists on the intermediate levels of complexity. For example, reaction patterns such as those of eating and fear are incompatible. Also the patterns of sexual behavior and anger do not coexist. Again, an animal cannot swallow food and reject it simultaneously, nor can he like and dislike any other object at one and the same time.

On the highest levels of complexity, conflict is well known. Luria has pointed out that the cortex and recent elaborations of the brain restrain the reactions of the older, more primitive systems.

In the preceding chapter we saw that when a disruption of organized behavior weakened or removed cerebral inhibition there was a reversion to the more basic types of functioning. These biologically primitive urges, which are held in check by the cortex, are aroused in all the serious conflicts of life. The soldier in the front-line trenches may have a strong urge to run away from the exploding shells but is restrained by a sense of duty which was built up through military discipline and religious training. In other words, the biologically primitive impulse to escape from danger is blocked by the cerebral organization. Again, a man is infatuated by another man's wife, but attitudes based partly upon fear and partly upon the prestige motive restrain him from making ad-

vances. Finally, cerebral inhibition is present in a hungry man standing before the window of a food shop but restrained from breaking the glass by fear of the consequences and by attitudes based upon self-regard.

This inhibition of a basic urge by cerebral processes is one of the primitive forms of conflict. The inhibition may be brought about in various ways. The simplest form of thwarting is that occasioned by continued absence of the goal object from the immediate environment; to be specific, the animal is thirsty but there is no water in the surroundings. Most experiments upon animal motivation utilize this form of thwarting, and interpose some kind of obstacle between the subject and his goal. A basic urge may also be obstructed by factors within the individual. If a boy is crippled, for example, he may wish to play baseball, to swim, or to go on hikes, but be physically unable to do so. If a girl is homely, she may crave a normal marriage but be unable to attract the desired husband. Physical limitations generally bring a feeling of inferiority, as we have noted in a previous chapter. This is largely because they obstruct various motives of the handicapped individual.

Other fundamental sources of thwarting are found in the social and economic restrictions of the environment. A person's caste, race, creed, his station in society, as well as the amount of wealth he possesses, limit on every side what he can and cannot do. There are innumerable customs and taboos which regulate, direct, and obstruct the fundamental motives of men. When these social and economic restrictions become too severe, the individual complains that he lacks freedom and will fight to free himself from the inhibiting conditions.

Mental Conflict. Mental conflicts are vastly more complex than the relatively simple antagonisms of movement considered above. In mental conflicts there is an incompatibility of attitudes, or a clash of fundamental determinations.

As most persons know, Freud and his followers emphasized the paramount importance of the sex motive in human conflicts. The following case, quoted from Brill's book, *Fundamental Conceptions of Psychoanalysis*, is true to the Freudian conception.

A young woman went from doctor to doctor complaining of a pain in her arm. At last a neurologist pronounced the pain hysteri-

cal in origin rather than organic, and questioning revealed the following story:

She is a young woman who had made the acquaintance of a college student. As time went on, they became more and more intimate and it was rumored that they were to be married; in fact she thought so too. Upon graduating, he left the city and kept up a long correspondence with her. He came and spent his vacations with her; but he did not propose. The general impression was that, as he was a young man, he wished to make his way in the world before he married. Thus for years he came, spent his vacations with her, and left without proposing. The last year he wrote her with manifest enthusiasm that at last he had reached the goal of his ambition: he had received an appointment with such and such a salary. All the relatives heard about the letter and were now quite sure he would marry her. He came for his vacation, as usual, spent some time with her and took her out for a long walk the night before he left. But he did not propose. Everybody was disappointed; the mother was disgusted; her brother threatened to punch him in the face when he came again; and the poor girl was terribly grieved. She was told to drop him and think no more of him; she was willing to do so but claimed that it was much easier said than done. She argued that he must love her or else he would not write and spend his vacations with her; she felt that she was his only confidante. She did not realize that there are men who are so inhibited in their love life that they cannot propose. She was experiencing a mental conflict. She wanted [illegible] him; but there was no mistake about his loving her. He was a serious, quiet, well-behaved man who came from a very fine family and whom no one could accuse of being a trifler. "He certainly is not an adventurer, because he does not act like one," she would think to herself; "but why, then, does he not propose?" I would like you to notice the human, emotional element that enters into all these cases. Gradually, however, she made up her mind that he did not love her and that she would have nothing more to do with him. In time she was even ready to write to him not to correspond with her, but she could not gather sufficient strength to do so. Gradually there came on that pain in her arm.

When we go beyond the superficial aspects of this case, we find that it goes back to a fundamental condition in the past. We discover that the patient is suffering from the past, that the pain in her arm is only a monument of the past; it is a memento, one

might say, of her mental conflict. In other words, when she was emotionally arguing with herself whether he loved her or not and when she had to repress all talk about him, and make herself believe that she did not love him, her feelings, her emotions became converted into that of pain. The arm was the arm that he pressed on the night before he left. She would say to herself: "But what about that feeling? He pressed my arm"; for then she had hoped that he would say the expected words. Analysis reveals that it is that feeling that she wished to retain in memory that became a pain; it was a symbolic form of expression, for she could not talk about it in any other way. Without having to speak about the young man she could now unconsciously retain this episode through the pain in the arm. There was in a sense, a morbid gain. She could now talk and complain about her pain and thus have some form of expression, though the fundamental and deeper phase of her condition was submerged and she knew nothing about it. We see here a conversion of past emotion into something physical. When the patient realized this deeper aspect of her condition and when the painful past experience was brought to her consciousness she was cured. . . .

Although the sex motive played a prominent part in the above case of mental conflict, such a motive is by no means present in all. Any one of the basic drives may be thwarted and thus engender conflict, but in modern civilized society the thwarting of the sexual drive brings maladjustment more frequently than does the blocking of any other urge.

A case of mental conflict between the urge to flee from danger and a sense of religious duty was previously presented (pp. 12-14). In another example, described to the writer by a medical adviser in a Los Angeles High School, an urge for free self-expression in social life and play appears to be the foundation of the conflict.

A high-school girl suffered a severe nervous breakdown during which she was very excitable, cried easily, complained of headaches and the inability to sleep. Questioning revealed no unusual sex factor in the conflict. She was a girl with an expansive, dominant type of personality, fond of social life and always a leader in activities; she had been elected to offices in various student organizations. She was a girl of unusual ability and energy, but her personality development was being distorted by too much restriction

at home. The parents had kept her in evenings, wanting to protect her from what they regarded as the evils of the present generation, since they did not approve of the conduct of most modern young people. The girl had a normal love for her parents and no bitterness or awareness that the restrictions at home were the basis of her nervousness. The conflict was actually between an urge to lead a more complete, interesting life in which she could express herself and realize social pleasure, and a wish to please her parents and do as they desired. When the situation was explained to the parents the restrictions were lessened and the nervousness quickly disappeared.

Distinguishing Characteristics of Conflict. In any psychological consideration of conflict certain distinctions must be made. A number of the more important ones are listed below:

1. Some conflicts are *overt* and others are relatively *covert.* An overt conflict is one which takes place in the open; it can be clearly observed by everyone. For example, two dogs fighting for the possession of a bone are in overt conflict. The small child crying and struggling to get back a toy which has been taken away from him is in open conflict. The struggles of primitive men for any desired object are generally carried on in the open. In contrast to such clearly manifest conflicts are those which are covert, hidden from the outer view. The individual in conflict is conscious of an inner blocking, but strives to conceal it from others. Frequently a covert conflict endures for months or years; in this case the individual remains maladjusted, not openly expressing the spurs and checks of his inner conscious field. The difference between overt and covert conflicts is one of degree. The motivational framework is the same in both cases, but the amount of outer expression is variable.

2. Some conflicts are *temporary* and others are relatively *permanent.* Temporary conflicts are likely to be inconsequential whereas permanent ones probably have something important at stake which makes them continue. Some unsolved conflicts of early childhood have left permanent neural traces which from time to time become manifest in behavior.

In considering the contribution of psychoanalysis to psychology Thurstone wrote: "We psychologists have devoted ourselves almost exclusively to the phenomena of *momentary mental states and mo-*

mentary behavior whereas the psychoanalysts have given their labors to the phenomena of *basic and permanent tendencies in human nature*." The distinction between momentary and permanent is a relative one.

3. Conflicts are *trivial* or *important*. A conflict over going to a show *versus* studying a lesson is trivial from the standpoint of a lifetime. But frequently the total happiness of a life is at stake, or perhaps a fortune, or the fate of a nation swings in the balance. A conflict which seems important to the child appears inconsequential to the adult; and similarly a conflict which is vital to an adult becomes trivial when viewed in historical perspective. But regardless of the way in which a conflict is considered, differences of weight, importance, or consequence arise.

4. In some conflicts one factor or perhaps the whole conflicting situation is *consciously known* by the individual; in others a good part of the conflict is *unconscious*. An individual may not clearly realize, for example, that prestige motivation is a fundamental factor in his conflict, unless the desire for superiority is specifically pointed out to him. Freud and his followers have stressed the unconscious factors in conflict: a sexual wish of childhood, for instance, may have been so completely repressed that an individual remains unconscious of it and ignorant that a real conflict exists. Again, rationalization serves to conceal the true motives which in many cases have not been formulated or consciously admitted by the subject. Conscious conflicts, by contrast, are those which exist in the field of awareness; the elements are known.

5. Some conflicts are relatively *simple* whereas others are *complex*, depending upon the number of motivating factors involved. The simplest ones are those in which a single impulse is thwarted. During infancy, for example, there are innumerable impulses to reach for objects, to explore things visually and manually, to creep around, to place things in the mouth, to suck, and so on; if any one of these impulses is blocked by the environment, a state of conflict exists. Generally the blocking of an impulse in infants and small children is expressed by crying. With adults the blocking does not ordinarily lead to crying because custom requires that emotional expressions be suppressed.

A simple illustration of thwarting an impulse is the following.

When the telephone bell rings *once* the writer starts for his phone; if working at the desk, he stops and turns toward the phone; if walking toward the door, he instantly reverses the direction of movement. Now this particular phone is on a two-party line, and the second party has a ring of *two* bells. It not infrequently happens that when the bell rings *once* I start toward the phone and when the second ring comes I inhibit this impulse. Such minor interruptions and checkings of impulses are relatively simple and unimportant.

In all the more complex conflicts at least two determinations to act swing in the balance. Shall I go to the store and do some shopping? or shall I stay home to continue reading this interesting book? Shall I continue working on my lesson? or shall I follow the crowd to the fire? At the fork in the path shall I turn to the right or to the left? Shall I study law or medicine? The most complex conflicts of all are those in which many determining factors are operative. Any practical problem with a number of *pros* and *cons*, calling for deliberation, presents a complex conflict of this type.

6. Often the conflict is over the *means* of reaching a given end rather than over *goals*. A simple example is the motorist in conflict between two roads to the same town; the one is shorter, but the other is smoother going, here the decision between the roads concerns the *means* of reaching the goal. More important conflicts often have a certain amount of common motivation which supports both alternative means of attaining a goal. For example, if a youth is in conflict over the selection of a vocation, and is considering both medicine and the law, there is a common urge to find *some* vocation which will bring financial independence, self-expression, opportunity for development, standing in the social group, the possibility of founding a home, and so on. Again, it not infrequently happens that a girl is in conflict over the acceptance of this or that suitor; often the two suitors are both attractive as lovers and prospective husbands. Whether the girl clearly realizes it or not, there is here a single mating urge at the basis of the conflict. Such situations where there is a single motive and a conflict as to means should be contrasted with those in which two

distinct forms of motivation are opposed, such as hunger and sex, or pain avoidance and prestige.

In the last analysis, the well-known distinction between *means* and *ends* is probably a logical rather than a psychological one. Hence there is some question as to whether or not the distinction belongs in the present list. Stated psychologically, the point under discussion could be covered by distinguishing between the primary goals (ends) and the secondary, derived goals (means). On this basis the means-end distinction becomes psychologically significant.

The Relative Dominance of Motives. In the dynamic interplay of motives some determinations dominate others. Let us take as an extreme example a man absorbed in reading a novel when his finger comes in contact with the glowing tip of a cigar. At once he withdraws the hand; for the moment the whole determination to read is held in abeyance. Pain-avoiding responses are prepotent over others; they dominate.

Often, of course, conflicting determinations are of about equal effectiveness, as in the following illustration. The writer once offered a four-year-old boy a piece of candy, holding before him a large box with many shapes and sizes of chocolates—some wrapped in green, some in orange, some in silver-colored tinfoil. The youngster's eyes roamed about the box for a few long seconds before finally settling upon the largest piece of all. Various impulses to reach were aroused by the presentation of candies with so many different appearances; the balance of these nearly equivalent impulses made the decision slow and wavering.

One can state dogmatically that when two motives, or two motive-groups, are opposed, the stronger dominates. This, however, begs the question since the only way to know which of two motives is the stronger is to observe them in opposition and note which one dominates. It would be wiser, after one motive has dominated over another, to state that the dominant one has a superior effectiveness; but such a statement is an obvious truism.

That one determination dominates others is a fact so clearly manifest that it scarcely needs to be demonstrated. Often there are hierarchies of motives. If, for example, a hungry savage is determined to hunt for food, he first has to cross the lake to the hunting grounds; this necessitates launching his boat and pad-

dling; this last necessitates going to camp where the boat and paddle are kept. So the hungry man is looking in the camp for a paddle, to carry with his boat to the water, to paddle across the lake, to hunt for food to eat; but each of the partial acts motivates innumerable more subordinate actions, such as pulling aside the tent flaps to look inside for the paddle. There are thus prolonged sequences of activities in which some are prerequisite to others. Tolman has written of "determining adjustments" which dominate particular subordinate acts. The adjustments are relatively stable, but the subordinate activities are variable. These determining adjustments, moreover, form hierarchies from the most dominant to the most subordinant. The facts which Tolman is describing could also be stated in terms of primary and secondary goals. An illustration from Hamilton's work with monkeys shows this.

Two small monkeys were eating in peace close to one another when a larger approached with threatening croaks, obviously intent on an attack. The monkey nearest to the approaching enemy quickly turned upon his companion, and by screaming angrily at him enticed the large monkey to join in pursuit of the innocent victim. This feigning of an attack upon the innocent monkey (which might well be named the *Judas* reaction) obviously functioned as a self-protecting device. The pattern is not uncommon with people; when a mob attacks, for example, it is sometimes possible for the victim to join the mob, directing it to another victim. In fear, everything is changed.

One serious difficulty in considering the relative dominance of motives is the tacit assumption that the single motive is a constant element, whereas actually no such constancy of isolated motives exists. Change one factor in the motivational framework and the total balance is disturbed.

ADJUSTMENTS TO THWARTING

In the following section some of the normal adjustments and non-adjustive responses to thwarting are considered, along with a few abnormal reactions to the blocking of motives. Although the facts mentioned below are in some instances described in terms of a borrowed Freudian terminology, the writer finds nothing in them

which cannot adequately be interpreted by the motivational principles of the previous chapters.

Adjustment through Avoiding the Source of Difficulty. One of the simplest kinds of adjustment is to avoid the source of difficulty. An animal is given an electric shock; he jumps away and soon learns to be more cautious in approaching the place where the shock was received. A man finds himself working in a freezing cold field; he runs to the warm house. A housemaid does not enjoy the humiliation of having to take orders nor the irksome, menial labor; without an explanation she simply walks out. This brings her a sense of independence and superiority while at the same time it removes the load of housework.

Adjustment through Inhibition. The social environment sometimes requires that one inhibit his urge to act. For example, the impulse to strike a rival must generally be blocked in polite society. The impulse of the soldier to run away from danger must be inhibited by sentiments of duty. The sexual motive does not freely express itself in the presence of every attractive person of opposite sex, but it must be restricted in its outward expression. Adults may wish to cry, but crying is recognized as a regression to the level of childhood; so far as possible weeping is inhibited in a social group. The adult frequently inhibits his self-assertive motive; he refrains from openly showing his skill and knowledge because humility is expected in most quarters. During minor conflicts over plans and courses of action one determination is repeatedly blocked by others.

Now in these conflicts of determination the individual is often fully aware that one motive is being dominated over by another or by a group of other motives. The blocked motive simply vanishes and that is the end of the matter unless the inhibited determination is re-aroused. In such adjustment through inhibition the individual usually identifies himself with the dominant motive, so that there is a sense of self-determination or voluntary choice.

Adjustment through Learning. In most experiments upon animal behavior some motive is deliberately thwarted by the experimenter to make the animal work. To this thwarting the animal responds by learning—to run a maze to the goal-box, to discrimi-

nate among forms or colors, to escape from the puzzle-box, to cross an electrical obstruction, and so on. Solving a problem through a process of trial and error is a normal result of thwarting. The trial-and-error activity presupposes a relatively stable motivation as well as varied responses of the organism, many of which are maladjustive but some of which are adaptive. The adjustive reactions are the ones which bring the organism to his goal or remove the annoying excitation.

As an illustration of adjustment through trial and error consider a boy standing on the sandy bank of a lake, eager to get out to his boat. His first trial activity is to remove shoes and stockings in order to wade out to the boat, but he soon finds that the water is too deep to reach it in this way. Next he takes an oar, wading out again in an attempt to force the boat ashore; although the oar touches the boat it only causes it to float farther away. Then the boy comes to shore, sits down to think about the problem of reaching his boat. His eye casually falls upon another boat down the beach not far away. Aha! The solution is clear! He unties this boat, rows out, and brings his own craft to shore, thus making an adequate adjustment to the baffling situation.

The ability to solve problems is an index of intelligence. In the above situation a younger or more stupid boy might sit down crying on the bank, or appeal for help, or he might altogether abandon the attempt. Such activities are non-adjustive. A brighter boy might discover an unusual solution such as tying a cord to a stone, throwing the stone into the boat and slowly pulling the boat to shore.

Persistent Non-Adjustment. The trait of persistence which leads the organism to continue in varied responses until an adequate adjustment is made sometimes reveals itself in persistent non-adjustive responses. When an animal is confined behind the bars of a cage with food outside he tries to force his body through the bars. Stupid animals like the hen, Köhler has shown, attempt over and over again to press their bodies through the bars. They persist in a non-adjustive type of activity when there is no possible solution of the problem.

An example of an abnormally persistent, non-adjustive activity is that noted by Lashley in the cat. An adult male, two years old,

was observed to persist in sucking at the fur and skin of other cats; if uninterrupted, he would continue for hours, even drawing blood from the neck of his companion through continued sucking. Another animal taken from the mother before she had learned to drink was fed by hand and permitted to suck at bits of rag which had been soaked in milk. After four months this latter kitten was observed to lie for half an hour at a time sucking on the tassels of a woolen curtain, making loud smacking and gurgling noises. She refused to be distracted by food or by mild punishment, and even sucked at threads moistened with a weak acid.

Human subjects, too, show the same kind of persistence in non-adjustive responses. A two-year-old girl is tied to a rope which keeps her from playing in the street; she pulls repeatedly on the rope cinching the noose tighter and tighter around her chest until she cries from pain. There is no means of escape possible to her, but she persists in the non-adjustive activity.

A young woman has been neglecting her personal appearance, wearing her hair carelessly, dressing in a slovenly manner, neglecting the proper care of hands and face, with the result that her husband acts more or less indifferent and begins to cast eyes upon younger and more beautiful girls. Instead of seeking to improve her appearance, thus meeting the difficulty squarely, the young woman persists in her careless manners. She says that her husband doesn't love her, becomes discouraged about the situation, and with this attitude is all the more neglectful. There is obviously some inability to solve the problem intelligently.

The archives of abnormal psychology and psychiatry are filled with accounts of persistent useless activities. These are called by various names, such as: perversions, phobias, obsessions, compulsions, tics. Their nature, symptoms, etiology, and correction vary widely from case to case.

Regression. We have seen that the thwarting or blocking of a determination sometimes leads to emotional disruption of behavior with the appearance of biologically primitive activities—snarling, snapping, biting, and so on. These primitive activities would be appropriate in the jungle, but they are not appropriate in a highly socialized group of men. This return of behavior to a more primitive pattern is known as regression.

It is not uncommon for a man to lose his head and threaten to fight; but under civilized conditions this is regressive. Again, when an adult reacts to a difficulty by persistent crying or by climbing upon mother's lap, he is behaving like a child. Such patterns are regressive; they are reversions to earlier types of activity.

In the complications of modern life relief and relaxation can often be found through a return to the more simple modes of existence. The business man enjoys a camping trip or picnic; he gains genuine satisfaction in eating the nearly raw meat which he has scorched on a dirty branch over a crude camp fire, or in sleeping on old blankets upon the hard and cold floor of a cave. The primitive occupations of fishing and hunting are pleasing in good part because they are simpler modes of existing than those found in a modern office. The difficulties and problems of life are set aside when a man reverts to the simpler life; it is a way of lowering mental tension. This kind of regression, in contrast to that cited above, is deliberate and voluntary.

The process of regression by which one escapes present maladjustment through a more or less blind return to an earlier level of adjustment is well illustrated by the following case known to the writer. The subject is a beautiful young woman who for years had been caressed and loved by her parents. The parents were wealthy and had consistently showered gifts and attentions upon their only child; they placed her upon a pedestal, believing their daughter to be nearly perfect. At the age of twenty-two she married a brilliant, industrious young lawyer. From him she expected to receive all the loving attentions, gifts, and flattery that early training had taught her to accept as her due. The husband, however, turned out to be much less demonstrative than she had anticipated; in fact, he expected his wife to be somewhat aggressive in showing love for him. The immediate consequence of the marriage was unhappiness and maladjustment. The young couple talked things over frankly and finally decided to live apart for a few months, in the hope that they would grow to miss each other and could then renew married life with devotion. So the girl stayed on a ranch with friends for several months; but after returning to her husband the maladjustment was fully as severe as before. Instead of trying to make herself more attractive to the husband and

being demonstrative with him, she spent many hours in crying and complaining that her husband did not love her. At about this time she started to pay long visits to her parents, who resided in a distant city. They were always delighted to see her, treated her like their little child, showering fur coats and other gifts upon her, all the while making affectionate demonstrations. Each time when she returned to her husband after a visit at home she missed more and more keenly the love and attention which her parents gave. The husband became restrained and preoccupied with his work, finding it unnatural to make the expected display of attentions. At this time the young woman frequently unburdened her troubles to an intimate friend saying, "All I long for is a little love." The visits to her parents' home became increasingly frequent and of longer duration; she showed less and less concern for the husband and displayed a weakening determination to work out a satisfactory love life with him. After a few years they were divorced; and the young woman made a permanent home with the parents, resuming her childhood relationship to them.

In this case the firm fixation of the young woman upon her parents and the incestuous love of the parents for their daughter would have made any marital adjustment difficult. Instead of facing the situation and working out a real solution of the marital difficulty there was a regression to an earlier mode of behavior. It was the easiest way out of trouble.

Similarly the old man who turns to memories of his youth and childhood instead of facing present problems is escaping reality by an imaginative return to the past, which avoids the actual difficulties of present conditions.

Reactions of Self-Defense. When the self-esteem of an individual has been lowered, when his craving for free expression, success, power, or prestige has been thwarted, this blocking has a considerable variety of manifestations.

Projection. One of these is placing the guilt or blame upon someone else. The small child, for example, quite openly blames another person or thing for his misdeed, as in this typical illustration.

A little girl of four years was visiting her grandfather on the farm. The grandfather was a domineering, austere type who inspired fear in children. While the little girl was playing in the yard

she discovered a wooden trough where horses are watered, and she thought what fun it would be to climb up and splash her hands in the water. With effort she climbed up but slipping fell in head first. Sputtering and choking the little girl climbed out, covered with green scum and dripping wet. As she started toward the house the grandfather met her and laughed at the sight. The girl stamped her foot on the ground saying, "See what *you* did."

Almost any human failing may be the ground for reactions of self-defense. It may be a physical defect, real or imagined, some failure of knowledge or skill, an inferior social or economic status. The following case shows the defense reaction of a poor ignorant fellow who was not able to answer arguments which were poured forth by a young and well-informed graduate student. The latter, fresh from the books, presented arguments and evidence for the doctrine of evolution in a one, two, three fashion. The listener had not completed the grammar school but believed fervently that the story of creation as told in Genesis was literally true. He was quite unable to answer the arguments and points made against him. Finally, becoming angered he wanted to fight. The flip young man, he said, was entirely ignorant of evolution, had never studied the problem, and had better go back to school to get some sense knocked into his head. The ignorance and inadequacy of the older man were projected away from himself to the graduate student.

When one hits his finger with a hammer while driving a nail, one is apt to swear at the hammer or to find some fault with it or with the nail. In an auto accident it is human to shift blame and responsibility to the other party if at all possible; the whole practice of giving alibis rests upon this principle. The belittling of others or blaming them saves one's own face. There are persons who constantly project blame for their shortcomings upon others, and who habitually undervalue the achievements and success of others. These reactions are face-savers, *i.e.,* prestige-preservers.

The pattern is as old as human nature. When Adam had partaken of the forbidden fruit he replied to Jehovah: "The woman whom Thou gavest to be with me, she gave me of the tree, and I did eat." Then Jehovah turned to the woman with the question: "What is this thou hast done?" And Eve replied: "The serpent beguiled me, and I did eat."

Identification. Another means of elevating one's self-esteem in the face of some limitation or thwarting is through a process of identification. A clear case is the identification of parent with child such that the parent gains a sense of success and achievement through the activities of the child. If the child is beautiful, clever, capable, the parents are proud, that is, their level of self-esteem is raised. But such identification may have the opposite effect; undesirable behavior on the part of the child disappoints the parent, bringing in its wake a sense of failure and humiliation. Some adults habitually talk about their distinguished relatives, about the famous people they have met, about their eminent friends. Such an identification of one's self with worth-while people bolsters up self-esteem. If exaggerated, it may indicate a need for such a self-elevation to compensate for a sense of inferiority.

In the novel and on the screen one identifies himself with the hero, and thus leads an imaginary life of luxury, success, excitement; the story lifts one out of the commonplaceness of a humdrum existence, provides an imaginary escape from some difficulty. Often this process of identification extends to inanimate things. Fisher gives the following account:

A farmer in a western state had a threshing machine engine which he had named "Betsy." When Betsy functioned properly, the owner was all aglow with pride and happiness. He would walk about proudly calling the attention of others to Betsy's power and smoothness. But when something went wrong with Betsy, the look of pride and happiness became replaced by one of worry and deep concern which would last until Betsy was again "well." He would often speak of his engine as "My Girl" and never grew tired of telling of her remarkable achievements.

Rationalization. Identification and projection are distinguishable though closely related psychological processes. Fairly distinct from these is the defensive reaction of rationalization. When the motive for an action is one which the individual considers unworthy or believes some other person will regard as unworthy, a false reason for the act is assigned. For example, if a man is caught stealing a ride on the street car, he explains, "I thought that the railway company would not miss my nickel; they are such a big concern that five cents doesn't matter." But this thought came *after* detection;

it is an *ex post facto* defense to put the man's conduct in the best possible light rather than a significant part of the original motivation. This false reason conceals the true motive from the individual himself.

Actions which are carried out impulsively, unthinkingly, or semi-automatically, need to be rationalized to preserve self-esteem and the fiction of rationality. A man was jealous of a rival who became engaged to his best girl friend and former fiancée. The first said that his rival was quite crude socially and for this reason he did not like him. The alleged reason in this case is obviously a rationalization.

Substitute Activities: Results of Thwarting the Sexual Drive. The manifestations of thwarted sexual motives are so manifold that many pages would be needed to treat the topic adequately. The sexual urge is held in check by attitudes which the individual has derived from his social environment. Sometimes these anti-sexual attitudes dominate activity so completely that behavior portrays a negation or denial of the sexual motives. The person who is sexually negative is known as a prude, and the anti-sexual attitudes are the psychological basis of prudery. When the sexual drive is completely thwarted perversions are very likely to appear. But before one can discuss perversions it is necessary to have a clear conception of normal sexual motivation.

According to the Freudian view the human individual passes through three stages of sexual development. During infancy there is no need for another person in the sexual relationship; the infant is self-sufficient. He derives pleasure from thumb-sucking, fondling himself, and in some cases from masturbation; the stimulation of sensitive and so-called erogenous zones brings the infant gratification which Freud regarded as sexual. This autosexual stage is followed by a homosexual one, during which the child is attracted to members of the same sex, or to members of both sexes indifferently. During this phase of development boys form fixations on other boys; girls become attached to other girls. Sometimes overt homosexual practices occur, such as fondling and mutual masturbation. In the third stage of normal development the individual becomes heterosexual. At the time of puberty the attraction to persons of the opposite sex grows markedly.

According to the Freudian theory, the mating urge is complicated by pairs of related impulses. The tendency to exhibit the body, especially the reproductive organs, to other individuals, generally persons of the opposite sex, is known as exhibitionism. The paired impulse to inspect or examine the bodies and especially the sexual organs of other individuals, particularly those of the opposite sex, is called inspectionism. Still another tendency associated with the sexual urge is to inflict pain or bodily injury; this is known as sadism. The impulse is found among animals as well as humans; it is manifest by biting, kicking, beating, and in other attacks upon the loved object. Sadism is opposed by an impulse which welcomes pain from the loved individual, deriving pleasure from such infliction of pain; this is called masochism.

Some individuals are abnormal in their organic development; their physical structure favors a permanent homosexuality. Others have the sadistic impulse so accentuated that they commit acts of cruelty. But most perversions of the sexual urge are manifestly based upon experience and are functional in nature.

Masturbation is so frequent that it might well be called normal; but it is usually regarded as a perversion for the reason that it is not the "natural" way to obtain sexual satisfaction. If children were not inhibited by the codes of morality taught them, and by the ever-watchful eye of adults, sexual intercourse would occur before puberty or shortly thereafter in the biologically normal and adequate way. Constant inhibiting of the sexual urge favors the appearance and continuance of masturbation. The more an individual is thwarted the more certainly will autoerotic practices be repeated. Individuals who are unable to find free self-expression in social plays, games, work, as well as in love, are the ones most likely to develop and continue the practice of masturbation.

Masturbation is no more injurious to health than the normal relationship, provided it is not excessive; it is not a cause of insanity. The trouble with the practice from the standpoint of mental hygiene is that it is bound up with a sense of remorse, with concepts of sin, filthiness, and moral degradation, with a lowering of self-esteem, with the idea that the practice shows lack of will-power, and the like. Also autoerotic practices are such an easy means of

obtaining sexual satisfaction that they are likely to be carried to excess.

There are other perversions such as permanent homosexuality, sexual frigidity, bestiality, necrophilia, and the like.* To a considerable extent these perverted sexual activities have become established as adaptations to an environment which placed severe limitations upon normal sexual expression. Behavior is an adjustment of the individual to the particular environment. To speak of perversion is to imply some sort of wrong orientation of the individual, but right and wrong are ethical rather than psychological conceptions.

The idea of perversion implies a turning aside of sexual activity from the natural channel into another which is unnatural and perverse. According to Freud, the sexual energy, or *libido*, may be directed into productive activities such as creating poetry, music, paintings, into philosophy, science, or religion. This diversion of *libido* into socially approved channels has been called "sublimation."

Sublimation is here conceived as the reorientation of behavior in which one kind of activity is substituted for another. This substitution frequently occurs in activities which have no reference to sex. For example, a child reaches for his father's gold watch and starts to play with it. If the father took away the glittering object without substituting another, the child would cry. Instead, he gives the child some other plaything, demonstrating its merits and how it works; playing with the new object becomes substituted for handling the watch, without crying or any other emotional disturbance. It is all a matter of reorienting behavior, of redirecting the child from one goal to another. Exactly the same takes place in substitution of literary creating for sexual behavior. There is no mysterious shifting of *libido* or psychic energy. The energy released by stimulations of the sexual mechanisms within the body and by sexually exciting situations within the environment may be directed into biologically normal channels, or it may motivate any one of a whole group of abnormal perverse practices. Thwarting the sexual motive

* For a more complete discussion of the results of thwarting the sexual motive, the student is referred to: Fisher's *An introduction to abnormal psychology* (New York: Macmillan, 1929; pp. xii + 512). Chapter XI deals with the sexual neuroses.

does not destroy it; it merely limits the form and degree of its expression.

Diffusion and Compensation. The cropping out in one direction of a motive thwarted in some other direction is the basis of what has been called "emotional diffusion." For example, if a man has been angered by his employer but refrained from showing emotion, he probably walks out of the office all pent up, writhing inside. Later he blames his stenographer unaccountably but with real ire for some minor slip she made; or he complains that the coffee is spoiled; or in the evening at home he spanks one of the children for some misdeed. The common view is that emotional tension aroused in one situation must find its release somewhere; the thwarted man is just "letting off steam," "getting it out of his system."

The tension can sometimes be released through talking. If the angered man would talk it all over with his wife, expressing anger, hatred, resentment, if he lived through the office scene again in imagination, saying what he wanted to tell his employer but didn't, the tension would be somewhat reduced. Similarly, the man who is thwarted in his love life may lower the tension by talking his troubles over with an intimate friend, or perhaps confessing to a priest. Such mental catharsis has a wholesome hygienic effect.

In many instances the thwarting which leads to diffusion and compensation is based upon a personal failure or deficiency. When the urge for prestige, for self-expression and success, is repeatedly thwarted, relatively a permanent tension becomes established. This is the case with the youth who is physically unable to compete with others on the athletic field, or the girl who is not invited to dance because she is homely. Such tension can be released in various ways. Perhaps the boy will turn with great energy to his studies, demonstrating in the class room that he is an outstanding student; perhaps the girl will turn to music or art, displaying in these pursuits an unusual industry and ability. The thwarting in one direction may lead to a compensatory activity in another. Thus the childless woman may compensate by showering love and care upon a cat or dog; this action substitutes for the normal love of mother for child. Freud pointed out that great works in music, literature, painting, science,

religion, philanthropy, have been repeatedly accomplished by persons thwarted in their love life.

Achievement in one activity bolsters up one's self-respect, and this partially makes up for the loss of self-esteem resulting from the thwarting of another line of conduct. Narrowly considered, compensatory activity and compensatory attitudes are based upon a sense of personal failure or deficiency, and compensation is the attempt of an individual to make good the inadequacy by activity in another direction (pp. 391-394). The man who is weak in one line compensates by becoming strong in some other line.

The psychological principle is the following: When a situation arouses a definite motive but at the same time thwarts it, the orientation of the thwarted motive and its energy-release persist. There are thus a conflict and a persistent tension. One form of adjustment to the conflicting situation is the reorientation of the individual so that the energy released may be expended in some new activity. This is what happens when a man "lets off steam," or "confesses his sins."

Repression. Experiences which are distasteful to the individual are often put out of mind. Those attitudes which threaten the moral integrity of the personality may be strongly rejected. Refusal to consider rejected attitudes and openly to face humiliating experiences leads to a kind of forgetting in which conscious recall becomes impossible. The repressed system of experiences, or "complex," continues to exist and to manifest itself in various ways. When some powerful and relatively permanent motive like the sex urge is repeatedly and persistently thwarted various neurotic symptoms eventually appear.

The irrational fear of water described by Bagby (pp. 9-11) illustrates repression. In this case, as in many like it, the full recall of the traumatic experience removes the phobia. Adjustment to a past conflict is made by recalling and reliving the distasteful experience.

Freud's conception of repression is bound up with his theory of the unconscious mind, for repressed experiences are said to exist in the unconscious. That they exist is demonstrated by psychoanalytic techniques which recall them, removing the neurotic symptoms. That they are unconscious follows from the fact that the normal waking personality does not have memory access to them nor any

voluntary control over the dissociated system. Some motives are unconscious in the sense that they have never been formulated into words and have never been definitely recognized as motives; but others are unconscious because of repression.

Dissociation. Dissociation has been the theme of several books and plays, most famous of which is Stevenson's *Dr. Jekyll and Mr. Hyde.* One of the classical examples of dissociation is that reproduced below, first described by William James:

The Rev. Ansel Bourne, of Greene, R. I., was brought up to the trade of a carpenter; but, in consequence of a sudden temporary loss of sight and hearing under very peculiar circumstances, he became converted from Atheism to Christianity just before his thirtieth year, and has since that time for the most part lived the life of an itinerant preacher. He has been subject to headaches and temporary fits of depression of spirits during most of his life, and has had a few fits of unconsciousness lasting an hour or less. He also has a region of somewhat diminished cutaneous sensibility on the left thigh. Otherwise his health is good, and his muscular strength and endurance excellent. He is of a firm and self-reliant disposition, a man whose yea is yea and his nay, nay; and his character for uprightness is such in the community that no person who knows him will for a moment admit the possibility of his case not being perfectly genuine.

On January 17, 1887, he drew 551 dollars from a bank in Providence with which to pay for a certain lot of land in Greene, paid certain bills, and got into a Pawtucket horse-car. This is the last incident which he remembers. He did not return home that day, and nothing was heard of him for two months. He was published in the papers as missing, and foul play being suspected, the police sought in vain his whereabouts. On the morning of March 14th, however, at Norristown, Pennsylvania, a man calling himself A. J. Brown, who had rented a small shop six weeks previously, stocked it with stationery, confectionery, fruit and small articles, and carried on his quiet trade without seeming to anyone unnatural or eccentric, woke up in a fright and called in the people of the house to tell him where he was. He said that his name was Ansel Bourne, that he was entirely ignorant of Norristown, that he knew nothing of shop-keeping, and that the last thing he remembered—it seemed only yesterday—was drawing the money from the bank, etc., in

Providence. He would not believe that two months had elapsed. The people of the house thought him insane; and so, at first, did Dr. Louis H. Read, whom they called in to see him. But on telegraphing to Providence, confirmatory messages came, and presently his nephew, Mr. Andrew Harris, arrived upon the scene, made everything straight, and took him home. He was very weak, having lost apparently over twenty pounds of flesh during his escapade, and had such a horror of the idea of the candy-store that he refused to set foot in it again.

The first two weeks of the period remained unaccounted for, as he had no memory, after he had once resumed his normal personality, of any part of the time, and no one who knew him seems to have seen him after he left home. The remarkable part of the change is, of course, the peculiar occupation which the so-called Brown indulged in. Mr. Bourne has never in his life had the slightest contact with trade. "Brown" was described by the neighbors as taciturn, orderly in his habits, and in no way queer. He went to Philadelphia several times; replenished his stock; cooked for himself in the back shop, where he also slept; went regularly to church; and once at a prayer-meeting made what was considered by the hearers a good address, in the course of which he related an incident which he had witnessed in his natural state of Bourne.

This was all that was known of the case up to June 1890, when I induced Mr. Bourne to submit to hypnotism, so as to see whether, in the hypnotic trance, his "Brown" memory would not come back. It did so with surprising readiness; so much so indeed that it proved quite impossible to make him whilst in the hypnosis remember any of the facts of his normal life. He had heard of Ansel Bourne, but "didn't know as he had ever met the man." When confronted with Mrs. Bourne he said that he had "never seen the woman before," etc. On the other hand, he told of his peregrinations during the lost fortnight, and gave all sorts of details about the Norristown episode. The whole thing was prosaïc enough; and the Brown-personality seems to be nothing but a rather shrunken, dejected, and amnesic extract of Mr. Bourne himself. He gives no motive for the wandering except that there was "trouble back there" and he "wanted rest." During the trance he looks old, the corners of his mouth are drawn down, his voice is slow and weak, and he sits screening his eyes and trying vainly to remember what lay before and after the two months of the Brown experience. "I'm all hedged in," he says: "I can't get out at either end. I don't know what set

me down in that Pawtucket horse-car, and I don't know how I ever left that store, or what became of it." His eyes are practically normal, and all his sensibilities (save for tardier response) about the same in hypnosis as in waking. I had hoped by suggestion, etc., to run the two personalities into one, and make the memories continuous, but no artifice would avail to accomplish this, and Mr. Bourne's skull to-day still covers two distinct personal selves.

The case (whether it contain an epileptic element or not) should apparently be classed as one of spontaneous hypnotic trance, persisting for two months. The peculiarity of it is that nothing else like it ever occurred in the man's life, and that no eccentricity of character came out. In most similar cases, the attacks recur, and the sensibilities and conduct markedly change.

In the cases of divided personality the independent systems commonly assert themselves alternately. Now one system, now the other gains possession of the mechanisms of muscular expression. Just as antagonistic reflexes work on an either-or basis, so the more highly complex systems within the personality alternately gain control of the final common pathways of behavior.

There are, however, cases of simultaneous functioning of two systems within the personality. In the phenomenon of automatic writing, for example, a pencil is placed in the hand of a subject who then writes upon a sheet of paper. With practice the hand writes fluently; sometimes in a foreign language which was earlier acquired by the subject, sometimes in poetry, sometimes in prose. Books of literary merit have been produced in this way. But while the hand is writing, the main personality is wholly unaware of what is going on, and unable to answer any questions as to what the hand wrote except by looking directly at the text as if a strange reader. Even questions whispered into the ear of the subject may be answered by the writing hand without the subject's awareness of the matter. This is an extreme form of dissociation.

The common variety of normal dissociated functioning is different in that there is always a vague awareness of both systems. The student, for example, who is half aware of what is being said by the lecturer but at the same time is drawing pictures on the arm of his seat or scribbling them in his notebook is carrying on two activities at once. What the pencil draws may be apparent non-

sense, but nevertheless it goes on simultaneously with the other activity of listening and taking notes. More often there is a sort of day-dreaming while the lecture is continuing. The student is thinking about a coming football game or the dance last night or perhaps he is building castles in the air. Wishes are realized in phantasy which have not been realized in the actual world.

The Retreat from Reality. The small child wishes he had a toy and dreams that he possessed such a toy; the dream is a substitute for reality and a means of realizing the thwarted wish.

In institutions for the mentally diseased there are always to be found persons who claim to be distinguished and exalted personages; but the claims can be shown to be without ground in reality. These delusions are impregnable to reason and logic; they depend upon "logic-tight" compartments in the mind. To an outsider they appear to be phantastic departures from the real world. The study of such cases often reveals the basis to be in some kind of thwarting. The personality could not make adjustments in any way other than through this dissociation and retreat from reality. The attitudes assumed and the goals established may be purely fictitious, but through them the patient achieves prestige and success, or at least a sense of importance.

If reality presents insuperable difficulties and obstacles, the unstable individual may adjust by repressing and dissociating a whole segment of reality, taking refuge in the world of make-believe and pretense. The world of phantasy may in time come to take on the aspect of reality itself, and serve as a substitute for it. Thus, the thwarting of a motive sometimes leads to the development of an independent unreal system in which wishes otherwise unrealized arrive at their goals.

METHODS OF INVESTIGATING MENTAL STRUCTURE

We have previously distinguished between those sets and postures which regulate present behavior and the more or less passive organization which is latent until specifically aroused. The structure of a personality viewed from the standpoint of its past, present, or future behavior determination is here designated as motivational structure. The methods described below aim to throw light upon this structural organization of the individual. It hardly needs to

be added that the behavior of an individual cannot be adequately understood until his motivational structure is known.

The Test of Relative Values. The view that people have similar interests and values, which can be grouped just as leaves, crystals, or insects can be classified, underlies a study of G. W. Allport and P. E. Vernon. This research is based upon Spranger's sixfold classification of the major values of men. Spranger's six basic values can be briefly described as follows:

1. *Theoretical.* The dominant interest of the theoretical man is to discover truth and to systematize his knowledge. He is primarily an observer, a knower, a critical thinker. He may become a scientist or a philosopher.

2. *Economic.* The dominant interest of the economic man is the practical and useful; his fundamental urge is to satisfy human needs. His main concern is with business affairs of the world—production, marketing, credit.

3. *Esthetic.* The chief interest of the esthetic man is appreciation of form, harmony of tone, color, and fragrance. He seeks to enjoy the experiences of life for their own sake and to evaluate them from the standpoint of symmetry, grace, and fitness.

4. *Social.* The dominant value of the social man is the love of people, whether one or many. This love may be conjugal, filial, friendly, or philanthropic.

5. *Political.* The political man is fundamentally interested in power and prestige. Above all else he desires personal influence and renown. He is not of necessity a politician, but in whatever vocation he enters he places a high value upon power.

6. *Religious.* For the religious man the highest value is unity; he seeks to comprehend the cosmos as a whole. He is mystical, sometimes finding satisfaction in the affirmation of life and active participation in it, sometimes in the negation of life along with self-denial and meditation.

Within the personality some of these dominant values are incompatible, whereas others are congruent and mutually harmonious. For example, when a person objects to destroying the beauty of Niagara Falls in order to generate electric power, he places esthetic ahead of economic value in a situation where both cannot be preserved. Again, the man who affirms that education should be wholly

practical, and that the pursuit of science for its own sake is futile, expresses dominance of economic over theoretical values. Other basic values, as we noted, are compatible in the sense that they may exist harmoniously side by side in the same personality. Compatibility exists between economic and political values, between social and religious, and between theoretical and esthetic. On the other hand, social and religious values are both said to be antagonistic to theoretical; economic and political values are opposed to esthetic and religious.

Spranger's classification does not imply that a given individual can be placed exclusively within one of the six groups. On the contrary, all these interests exist to some degree in every personality, but their relative dominance varies from person to person.

In the value test of Allport and Vernon the subject is required to discriminate between items which represent the above dominant interests. For example, in Part I he is required to indicate a personal preference on controversial matters, as: "The main object of scientific research should be the discovery of pure truth rather than its practical application" (theoretical *versus* economic value). "Because of the aggressive and self-assertive nature of man the abolition of war is an illusory ideal" (political *versus* religious value). In Part II the subject is required to arrange in a preferential order four possible attitudes toward a situation or question, as:

Do you think that a good government should aim chiefly at—
a. More aid for the poor, sick, and old.
b. The development of manufacturing and trade.
c. Introducing more ethical principles into its policies and diplomacy.
d. Establishing a position of prestige and respect among nations.

In this question (*a*) is a social value, (*b*) an economic, (*c*) a religious, (*d*) a political. The subject's ranking shows the balance of values within him.

By treating the expressed discriminations numerically, summing up the scores, the relative weightings of the different values can be determined. It can be discovered to what degree a person is theoretical, economic, esthetic, social, political, religious.

This kind of attack upon the basic values of an individual is strikingly like an interest analysis. It is, however, based upon a philosophical system of dominant values which is methodologically similar to the classifications of "instincts."

If the value test proves to have usefulness in psychological work, that will be its pragmatic justification. There can be little doubt that some individuals are more practical, more esthetic, more religious, more political, more theoretical, more social, than others. So long as this is so, any direct experimental attack upon the problem of dominant and subordinate values is to be welcomed by psychologists.

Psychoanalysis. The aim of the psychoanalytical method is to bring to clear consciousness those past experiences which lie at the root of a mental disorder, and in this way to correct the disturbance by revealing its true basis and origin. Psychoanalysis aims to discover the patient's motivational structure. Since recall is effected through words, one source of difficulty lies in the possibility that critical childhood experiences have not been formulated verbally, and that these experiences, therefore, are not well integrated with the subject's verbal organization. Even the conflicting experiences of adolescence are often poorly formulated in words, which fact makes the verbal approach difficult. Sometimes the subject struggles in vain to put into words vague motives which have never been explicitly recognized as such.

In making a psychoanalysis the subject is required to relax and talk as words occur to him, to give a verbal picture of his past without any reservation. In attempting to carry out this task he is aided by the analyst. Associations come sooner or later to a blocking point where some resistance or barrier is met. These blockings or inhibitions mark the frontiers of conflict and maladjustment. Ordinarily they are tender spots of past experience which bring a show of emotion.

The method of psychoanalysis can best be illustrated by reporting an actual case which was thoroughly analyzed. The following case has been turned over to me by a well-trained professional psychoanalyst; it is presented here in an abbreviated form to illustrate some of the psychoanalytical methods and conceptions.

A young woman, twenty-two years of age, a University student, experienced an uncontrollable impulse to go on a spree of overeating; the compulsion recurred at irregular intervals and had been troublesome for the two or three years prior to the analysis. After completing a regular full course meal she would experience a compulsion to partake of various desserts, generally sweets, and would eat one after another, finishing with a package of cigarettes. Having finished the eating orgy she would feel depressed and remorseful. Thereafter for several days she would walk many miles and live on a restricted diet, refraining from coffee and other stimulants as well as meat. Following several days of normal living she would again go on another eating spree with the same resulting regrets and a sense of guilt.

In addition to the eating compulsion she complained of a sense of guilt about her social conduct, which can best be described as homosexual, but with no overt homosexual relationships. The girl was masculine in dress, appearance, and manner, and in circles of girl friends she went by the masculine name of Tommy. She gained partial support from her girl friends in the form of gifts, vacation trips, invitations, and the like. For instance, for more than a year she had been receiving a monthly allowance from one of her admirers, which fact she referred to as "selling her services" (prostitution).

When the young woman presented herself for analysis she had a rather heavy, sullen expression; appeared to be athletic, with a mannish style of clothes and hair-dressing. She was intelligent, talented in literature, well read, alert. She was working her way through school and had made loans at the University.

The analysis of the case required hourly sessions with the analyst several times a week for a year; after this the case was followed for several more years. The general technique was to get the subject relaxed on a couch in a quiet room and to aid her in recalling and reliving early experiences. The analyst sat at the head of the couch, out of view, and made notes inconspicuously as the work progressed. Dreams were recorded as they occurred from time to time and analyzed thoroughly. The aim of the technique was to get the patient to express with full emotional accompaniment the repressed and suppressed experiences of earlier life.

The first superficial analysis revealed conflicts in her social life. She had been unable to make social contacts with men, which fact she blamed upon a lack of opportunity. She had, in fact, not met

any man in whom she could be interested, and the ones she had met were regarded as mentally inferior to her. Even in sport she found that men could not compete with her, and spoke of them as "damn fools." The idea of marriage was revolting. The case was quite different with girls. She had plenty of girl admirers but no steady and lasting friendships. She spared no effort in getting a girl interested in her, but the minute she was sure of her conquest she lost interest and had no consideration for the girl. As noted above, she succeeded in obtaining gifts from her girl friends. From one girl she had more than forty-eight presents in her possession. When keeping house with other girls she managed not to pay her fair share of the expenses.

Her method of winning a social victory over other girls was to give talks on literature, poetry, to show her skill in sport, to read her own verses and compose special verses for her prospective friends, and so on. If all this was not sufficiently impressive, she pretended illness and secured results through an appeal for sympathy.

She was also in conflict over her religious beliefs, and felt that the "scientific standpoint" was responsible for this. At home her mother was very religious and always talked about the Lord. This was disturbing when she felt at sea about religion. During the third month of the analysis the girl suddenly left home; felt she should live among girls of her own age, and said she could not stand the mother's incessant talking about the Lord.

As the analysis progressed it became clear that the neurosis had some definite relation to her father with whom she was strongly identified. The father had been a professional man, but when the patient was eight years old he had lost his professional standing through unethical conduct and was forced to make a living by day labor. At this time his health failed and he had to be cared for like a child. The girl believed that her father was being punished for his guilt, that he was suffering from overindulgence in food, smoking, and possibly women (for which she had no proof). The girl described her father as indulgent in sweets as far back as she could recall. *He would purchase sweets secretly and share them with her*. He was a big eater and smoker. The state of his health was very painful and humiliating; she claimed her father had been dead for many years.

The mother figured throughout as a weak character, forever nagging and complaining, in poor health, suffering from headaches and

unable to meet the responsibilities of her home. Tommy describes her mother as a poor cook and deficient housekeeper. She never received any love from the mother and felt contempt for her. The girl had little chance of making a sound mother identification while the father presented at first a wholly different picture.

There was a firm father identification. In the overeating of sweets and food indulgence she was compulsively repeating the father's actions, symbolically being her father. She rationalized the craving for sweets, however, on the ground that she had never had enough at home because funds were always low. Also this father identification led her to adopt the masculine rôle in love-making, *i.e.,* to make love to women, which inclination was accentuated by the fact that her mother failed to present an acceptable model of the feminine rôle during the girl's formative early years. The sudden and violent disappointment in her father made this identification all the stronger.

After nine months of analysis the girl became acutely conscious of her homosexuality and undertook various experiments to prove to herself that she could attract men. She played the part of an aggressor but always selected love objects beneath her social level: bus drivers, fountain clerks, lumber camp workers, where she was bound to fail in making a permanent attachment. At this time she was not ready to take heterosexuality seriously, but at the same time her clothes began to take on a more feminine style and she started to wear jewelry. She was never quite sure whether partaking of a wholesome meal did not also imply gluttony.

The analysis revealed a whole series of early experiences in which sexuality had been associated with urination and with moving of the bowels. The processes of elimination as well as eating had, through her early formative years, become sexualized.

The analysis also made her conscious of the disrespect and hatred of her mother. She dreamed of women dying in childbirth. One day she found the analyst (a woman) reclining on a couch, and at this staged a terrible scene. She found herself in the same situation that had occurred to her at the age of four. She shouted out the great contempt and hatred that she had held for her mother, identifying the analyst with her mother. The incident was thoroughly analyzed, and almost from that very moment she began to show improvement. Eating lost its lure. She was able to cultivate her old friends without feeling uncomfortable in their presence. She was willing to be criticized. She returned to her mother's house to live

and found that the mother's religion did not disturb her; on the contrary, she felt that everyone was entitled to his own views. She made plans to advance in her work.

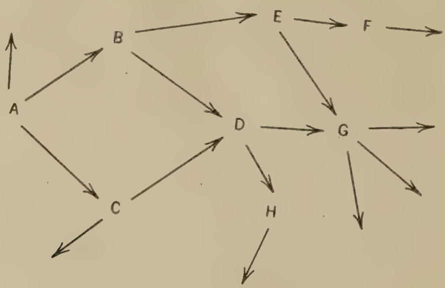
A report upon the case three years after the above analysis reveals that the young woman had married and appeared to be leading a normal, happy life. She was contentedly carrying on some of her intellectual interests. The eating compulsion was gone.

Commenting upon the case and summarizing, the analyst writes that Tommy had not adopted the feminine rôle because the model of the rôle during her formative years was a superstitious, weak person—her mother. The father was also a weak person but she identified herself with him and copied him at an early infantile level when he seemed a great personage. The father disappointed her. The father identification was symbolized by eating. Tommy felt that eating took the place of sexual gratification. Also early experiences associated sexuality with the processes of elimination. There were infantile oral and anal traits which prevented her from making a normal heterosexual adjustment. When all these elements were consciously exposed in detail there was a serviceable reorganization of the personality.

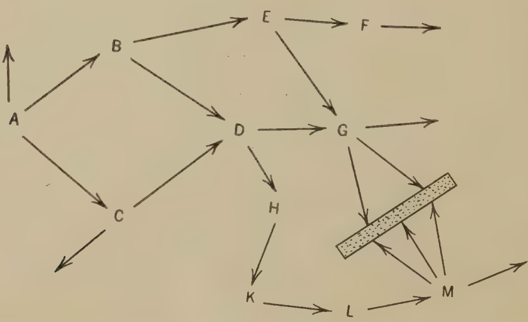
One does not need to accept the bizarre interpretations of Freudian psychology to realize the scientific and practical importance of a method which lays bare unconscious motives, early conflicts and evaluations still affecting the adult personality. Through the recall of childhood events and the reliving of the repressed experiences with emotional vividness, attitudes are changed and the personality reorganized. Compulsions, phobias, and other neurotic symptoms can often be removed when they have been derived from the patient's past experience.

The psychoanalytical method presupposes an equivalence between words and the vital situations which engender conflicts. Because of this one can reinstate imaginatively those situations and events of the past which are the source of trouble. Former experiences if they have occurred at the same, or nearly the same, time or place are bound together by associative bonds. If we symbolize concrete experiences by letters, instead of words, one experience (*A*) suggests others (*B*, *C*, *D* . . .) which were formerly associated with it. The sequence of associated experiences does not move in a single

straight line but spreads outward simultaneously in many directions, as represented below.



Now if the associative reconstruction continues long enough, a conflict situation will inevitably be encountered. The associative sequences will reinstate some blocking or thwarting, some unsolved conflict or difficulty of the past to which no adequate adjustment was made at the time. The place of thwarting may be represented by the solid barrier as in the following elaboration of the first diagram.



The associative network of the mind is relatively stable and constant, which fact makes it possible to recall unsolved conflicts and other past experiences over and over again.

The Controlled Verbal-Association Method. In the controlled verbal-association method, developed by C. G. Jung as an instrument for detecting "complexes" (*i.e.,* repressed systems of experience which are emotionally toned), the subject is presented with a stimulus word and instructed to respond with the first word which it suggests. The list of stimulus words is carefully selected either with respect to some particular series of experiences or with

respect to the general diagnosis of maladjustment. In the general application of the method some of the stimulus words are emotionally indifferent, as "table," "air"; other words are indicators of complexes, as "jilted," "woman."

In demonstrating the controlled verbal-association method before a class, the following procedure has been used. Two students are selected to carry out some rather unusual instructions; then to wait in an anteroom until an assistant brings them, one at a time, into the class room. For example, in one demonstration conducted by the writer, the first student was instructed to examine three white rats, taking one at a time from the cage, counting the teeth, noting the eye color, etc.; the second student was required to study a human skull, to open its jaw, to eat candy hidden in the cranial cavity, etc. Both instructions aimed to create a vivid, unusual, and somewhat affective experience. The subjects were told at the start that the experiment aimed to discover their recent activity through a study of word associations.

After carrying out the instruction a subject was seated on a chair, his eyes closed and face turned away from the class. Then he was told to respond by speaking the first word suggested when a stimulus word, such as "chair," was pronounced. An assistant wrote down the responses upon a blackboard, recording the time (which was measured to the fifth of a second with an ordinary stopwatch) between stimulus and response. Some of the stimulus words were indifferent; some referred to the rat inspection, as "eyes," "cage," "rat," "bite," etc., while others referred to the skull as "bone," "jaw," "skull," "candy," etc. An examination of the response words demonstrated which subject had carried out each of the tasks.

Perseveration of significant words aided in the diagnosis (such perseverating responses are not at all uncommon in this well-known demonstration). A study of reaction times indicated that the response time was longer for certain highly significant stimulus words than for the controls, owing to some kind of mental blocking in the critical cases.

The above method has been employed to diagnose criminal behavior, the misdeeds of children, as well as suspected actions of adults. It is rendered useless if the subject refuses to cooperate, but when the subject cooperates in the psychological diagnosis of

conflicts and maladjustments the method is exceedingly useful. It is a refinement of the free-association technique employed in psychoanalysis.

Physiological Methods of Studying Emotional Conflict. The indicators of emotion are especially significant in the study of mental dynamics because emotion is dependent upon conflicts, upon the thwarting of motives, or the sudden disturbance of mental balance. An emotional response points to some maladjustment—temporary or stable. Hence it is especially important to study the bodily indications of emotion in relation to mental organization.

Heretofore the expressive methods have been employed mainly to investigate the peripheral changes of feeling and emotion in relation to various simple sensory stimuli. It is now very clear that emotional expressions must be scrutinized more carefully in relation to motivating factors. Darrow has made a good beginning in demonstrating that the peripheral changes in blood pressure and electrical skin resistance are different for sensory stimuli and for ideational presentations (p. 474). His experiment is suggestive of what might be accomplished by the patient application of physiological methods to the problems of mental dynamics. The direct attack, however, should be upon the bodily manifestations of conflict.

Various bodily indicators of emotion have been studied: changes in blood pressure; in the tonicity of blood vessels; in the rate and force of the pulse; in the activity of sweat, salivary, and tear glands; electrical changes in the body; variations in the rate and depth of respiration; and changes in the acidity of saliva and in the chemical constitution of blood and urine. Not all these bodily indicators of emotion are useful in diagnosing mental conflict. The real trouble is that the conditions of emotion are extremely complex and each individual has to be analyzed intensively to understand his motivational organization. With an adequate motivational approach the study of emotional expressions offers a rich field for research. The physiological methods are supplementary to the others described in this section.

The Neurotic Questionnaire. The current conception of "neurotic tendency" embraces several fairly distinct meanings. It is related to nervousness, to social maladjustment, to emotional in-

stability, and to psychopathic traits. The neurotic individual is likely to be hyperactive, highly excitable; *i.e.,* stimuli which do not disturb the normal individual release much energy in him.

The neurotic is maladjusted socially. Thurstone has suggested that "*the fundamental characteristic of the neurotic personality is an imagination that fails to express itself effectively on external social reality.*" The social expressions of his personality are inhibited; he lacks self-confidence in social relations; he constantly worries about himself. He is moody, vacillating between elation when his imagination is free and depression when he is painfully aware of the discrepancy between his imaginings and social reality.

An investigation of neurotic tendency among college freshmen has been made by L. L. and T. G. Thurstone. The subjects of this test were told that the study aimed to indicate various emotional and personality traits to aid college advisers. To create a favorable attitude the test blank was labeled "Personality Schedule." The blank itself presented a list of 223 questions, each of which was to be answered by encircling: yes no ? To illustrate, some of the questions which were found to be the most significant in differentiating degrees of neurotic tendency are listed below.

Do you get stage fright?
Do you have difficulty in starting a conversation with a stranger?
Do you worry too long over humiliating experiences?
Do you often feel lonesome, even when you are with other people?
Do you consider yourself a rather nervous person?
Are your feelings easily hurt?
Do you keep in the background on social occasions?
Do you often experience periods of loneliness?
Are you frequently burdened by a sense of remorse?
Do you worry over possible misfortunes?
Do your feelings alternate between happiness and sadness without apparent reason?
Are you troubled with shyness?
Do you day-dream frequently?
Have you ever had spells of dizziness?
Do you get discouraged easily?
Do your interests change quickly?
Are you easily moved to tears?

Does it bother you to have people watch you at work even when you do it well?

Can you stand criticism without feeling hurt?

Do you have difficulty in making friends?

Are you troubled with the idea that people are watching you on the street?

Does your mind often wander badly so that you lose track of what you are doing?

Have you ever been depressed because of low marks in school?

Are you touchy on various subjects?

Are you often in a state of excitement?

Do you frequently feel grouchy?

Do you feel self-conscious when you recite in class?

Do you often feel just miserable?

Does some particular useless thought keep coming into your mind to bother you?

Do you hesitate to volunteer in a class recitation?

Are you frequently in low spirits?

Do you often experience periods of loneliness?

Do you often feel self-conscious in the presence of superiors?

Do you lack self-confidence?

Do you find it difficult to speak in public?

Do you often feel self-conscious because of your personal appearance?

If you see an accident are you quick to take an active part in giving help?

Do you feel you must do a thing over several times before you leave it?

Are you troubled with feelings of inferiority?

Do you often find that you cannot make up your mind until the time for action has passed?

Do you have ups and downs in mood without apparent cause?

Are you in general self-confident about your abilities?

The total list of questions was compiled from similar ones employed by Woodworth, House, Laird, Freyd, Allport. The score is simply the number of answers returned which indicate some maladjustment; the maximum possible score is 223, but the actual scores ranged from 5 to 134. A high score represents an emotionally unstable personality with many specific traits which writers consider

neurotic; a low score indicates the absence of emotional strains and worries, it indicates a poised, well-adjusted individual.

The neurotic questionnaire and similar techniques for diagnosing individual differences are useful for selecting certain members of a group. For example, the test can indicate pretty well which members of a freshman class are in need of special help with their personality problems. The test, however, needs to be supplemented by other methods which throw a more definite light upon the individual's motivational structure.

Luria's Technique. Working in soviet Russia, Luria made extensive use of the controlled verbal-association method, simultaneously with measurements of the activity of voluntary muscles. Inasmuch as this intensive investigation of voluntary movement is Luria's main contribution to the methodology of studying conflict, his technique is worthy of special consideration.

Luria's subject was seated in a comfortable armchair in front of a table, his right hand resting lightly upon a metal capsule. The subject was instructed to press the capsule simultaneously with the word reaction in response to the stimulus word. Pressing the hand squeezed a rubber bulb which was connected to a tube and the latter to a recording tambour. By means of a kymograph and rotating smoked paper a record was obtained from which could be determined the strength of the voluntary contraction, the delay between stimulus word and movement, and the general pattern of voluntary movement from beginning of contraction to end of relaxation. Further, the left hand of the subject supported a weight which the subject was instructed to hold passively and quietly. Despite the instruction, of course, there were involuntary changes of muscle tonus which were recorded on the smoked paper simultaneously with voluntary contractions of the right hand.

A complete record contained a time line, a signal line, a curve of the voluntary muscular contraction of the right hand, and a curve showing involuntary tremor and indicating all variations of muscle tonus of the left hand and arm. In addition to this, the subject's verbal responses to the word stimuli were recorded, and his general behavior noted. Thousands of such records were made under a great variety of conditions.

The general aim of the investigation was to study objectively the

disorganization and control of behavior in concrete situations. Luria applied his technique to the study of vitally important conflicts and emotional disturbances. Several of the situations which he used are described below.

During the Russian revolution the higher schools and universities had been thrown open to nearly everyone, regardless of preparation for the work. Later it became necessary to eliminate large numbers of students to relieve the overcrowded conditions. Laboratory equipment was inadequate; academic progress had not been properly controlled; and there were various social factors which made it imperative to eliminate a large number of students from the schools by a thorough examination. The examination, because it eliminated so many students, was known as a "cleansing" or "purgation." In the spring of 1924 every student had to appear individually before a special commission which investigated his academic record, his social and political inclinations, and his past activity; on the basis of this inquiry it was decided whether or not the candidate could remain in school. In most cases a student's plans for the entire future depended upon the outcome of this single examination; it was vastly more important to the student than an ordinary school examination. At the time of the examination students lined up and went individually before the commission. Luria selected subjects for his experiment from those waiting in line for examination; some of them he tested just after the ordeal.

In another series of experiments the ordinary school examination in mathematics, physics, and social science furnished the situation. Subjects were taken just before and again just after it.

Criminals and those suspected of crime were also studied by Luria's technique. Some had been arrested just a few hours or days before they served as subjects; others were tested before they had been questioned and before told the cause of their arrest; a number were investigated just prior to trial and sentence, others just after. There were also experiments upon innocent people who had been arrested because suspected of some crime.

In still another series of experiments, conflicts upon vital matters were produced through hypnotic suggestion. For example, a young woman, a student of obstetrics, was placed under fairly deep hypnosis. It was then suggested that she perform an abortion upon a

woman who implored her to do so. The medical student protested that the operation is illegal; after this she was offered a bribe for producing an abortion, but still she protested. When awakened from hypnosis a test relative to this particular conflict was made by Luria's technique, and symptoms of conflict were found. Conflicts, Luria proved, could be both produced and removed by hypnotic suggestion.

One feature of Luria's work is that he employed situations of vital importance to the subject which consequently produced genuine conflicts. In another series of experiments he produced artificial conflicts and neuroses in order to observe the structure of conflicting processes.

FUNDAMENTAL POINTS OF VIEW TOWARDS PSYCHOLOGY AND THE PRINCIPLES OF MOTIVATION

In the foregoing chapters of this book we have used a great many terms which refer to motivation: drive, energy, urge, motive, set, goal orientation, purpose, inner adjustment, wish, want, need, desire, appetite, aversion, interest, will, suggestion, belief, attitude, feeling, emotion, sentiment, habit, incentive, stimulus, tension release, and many others with similar meanings. This formidable array does not mean that there are an equal number of significant motivational principles. On the contrary, we have too many concepts which overlap in meaning, and too many words.

This state of affairs can be attributed to the existence of diverse points of view within psychology. From the *physical standpoint* the study of motivation becomes one of mechanics. Behavior is movement; movement is caused by stimuli which release energy; stimuli arise from conditions within the tissues and from the outer world. Words such as stimulus, neural excitation, muscular contraction, muscle tonus, postural adjustment, set, and activity level describe in physical terms the processes of arousing and regulating behavior.

A wholly different group of words is needed when we look at motivation from the *standpoint of the conscious individual*. The individual is aware of purposes and desires, wishes, wants, and needs. He believes that these awarenesses reveal his own motives, and that feelings of pleasantness and unpleasantness regulate his

conduct. Moreover, he is aware of permanent attitudes of love or hate, anger or fear, which have been derived from the social environment and which regulate the course of his conduct.

When the psychologist looks at problems of motivation through the eyes of the individual he employs such words as: interest, conscious purpose, sentiment, desire, mood, emotion. These terms differ radically from the physical ones in that they are based directly upon conscious experiences described from the individual standpoint.

In the hope of clearing up some of the confusion which now exists within psychology because of the diversity of viewpoints, the author has presented below an analysis of the physical and mental standpoints, a formulation of the multiple-aspect view of the organism, and finally the hypothesis of a physical mind which he regards as essential to a motivational psychology.

The Contrast between the Physical and the Mental Standpoints. The psychologist, in common with all other men of science, starts his science by accepting the phenomenal world just as it is presented to him.* Observation and reflection lead to the making of distinctions within the given world—night and day, heavy and light, and thousands of others. Some of the more fundamental distinctions are represented symbolically in Fig. 83.

A B C D . . . represent the class of lifeless bodies observed during waking life: sticks and stones, houses and barns, heavenly bodies, etc. *M N O P* . . . represent a special group of bodies which, on the basis of certain characteristics, are described as living organisms: trees and all plants, bacteria, domestic animals, men, etc. The organisms move, grow, reproduce, and are sensitive to stimuli in a way which distinguishes them from lifeless bodies. Strictly speaking, *A B C D* . . . and *M N O P* . . . constitute a single series of physical objects. Sciences such as astronomy, geology, chemistry, physics study the phenomena represented by *A B C D*. . . . Biological sciences are concerned with *M N O P* . . . or else with the interrelations of *M N O P* . . . and *A B C D*. . . .

All the phenomena symbolized by the series *A B C D* . . . *M N O P* . . . appear to be *external* to the person who observes and investigates them. They seem to exist in their own right inde-

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* The argument of this section and the two figures have been taken from a paper by the writer entitled, "The phenomenological point of view." *Psychol. Rev.*, 1924, 31, 288-296.

pendently of any particular observer. This characteristic of externality and independence is symbolized by arrows pointing outward. The physical sciences investigate objects, events, relations and theories *as if* there were a real order of existence independent of any particular observer.

S T U V W . . . symbolize the class of phenomena which in everyday life we call "mental." Some of them, such as after-images, hallucinations, dream objects, appear to the subject to be external and objectively real. Often they are described as if they were objects of normal perception. This fact is represented by the outward-pointing arrows. Other mental phenomena lack this external character. Such are described as *my* feelings, *my* desires, *my* purposes. This reference to the subject is shown by inward-pointing arrows. Finally, some experiences, known to psychologists, lack both outer and inner reference, and for the sake of completeness we have symbolized these by the letter *W*. Examples are a tone which is heard as a bare, ongoing experience without localization and object-meaning, an ill-defined mood of anxiety referred to nothing by the subject.

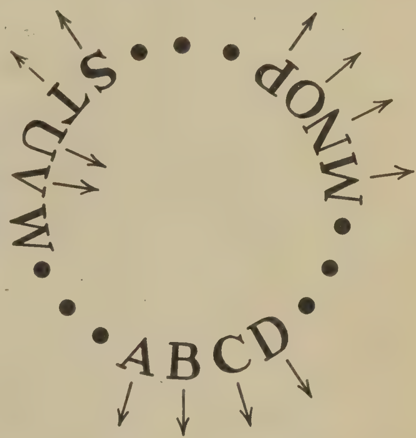

Fig. 83. Symbolic Representation of Different Kinds of Phenomena.

The figure portrays the distinctions between physical, biological, and mental groups of phenomena.

The three main groups of phenomena symbolized in the figure are not sharply marked off from one another. The distinctions are made only for convenience in handling a complex situation; their value is pragmatic.

The analysis up to the present point is straightforward enough but it ignores an obvious fact, namely, that everything symbolized in Fig. 83 (*A B C D* . . . *M N O P* . . . *S T U V W* . . .) is relative to some observer. All phenomena, just as they are given, with the meaning of objective reality, the meaning of individual conscious experience, and with the many other meanings not here considered,

are related to the body of the observer in such a manner that, if the nervous system be destroyed, all the individual's world ceases; if the nervous system be injured, his experienced phenomena may become disorganized; if the nervous system be subjected to a chemical change *via* the blood, or to a lesion, the individual's experienced world may be modified or vanish. Ether, fainting, a blow on the head, a dreamless sleep, wipes out the whole conscious picture. It is true for the psychologist, as well as for the most naïve person, that his *experienced* world depends for its structure and meaning upon neural processes within his bodily self. This fact does not change the phenomena represented in Fig. 83; it supplements them by bringing into the picture a new relationship.

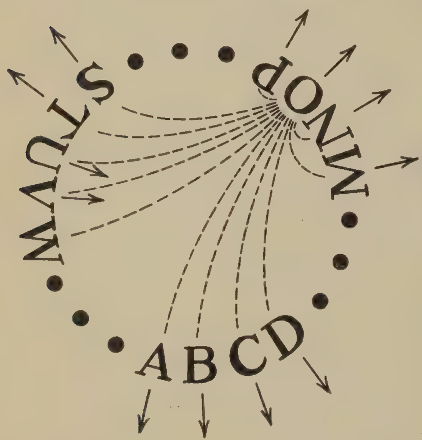

FIG. 84. SYMBOLIC REPRESENTATION OF THE EXPERIENCING RELATIONSHIP.

O represents any observer. The dotted lines symbolize the fact that every experienced phenomenon, just as it is given, depends for its existence upon bodily processes within the observer.

In Fig. 84, *O* represents the bodily self of any observing individual. *O* is a member of the biological series *M N O P*. . . . It is well known that all experiences which are commonly called "mental" are related to *O*. They are designated as the *experiences* of *O*, and explained by reference to bodily processes in *O*. The broken lines from *S T U V W* . . . to *O* symbolize the experiencing relationship between "mental" phenomena and *O*. But it is equally true that *A B C D* . . . *M N O P* . . . , in so far as they can be observed and described, are experienced by some individual and in this sense are "mental."

The term "experience" is here used to include all phenomena *just as they are given* (*A B C D* . . . *M N O P* . . . *S T U V W* . . .) whenever these phenomena are regarded as existences depending upon bodily processes within some *O*. To call a phenomenon an "experience" does not change it in any way; the designation merely points out a relationship discoverable within the phenomenal world.

The organism, *O*, of Fig. 83 is a *physical body*. It has mass; it moves when stimulated from without and when stimulated by tissue conditions within. Its behavior depends upon the excitation of nerves. The organism, *O*, of Fig. 84 is a *psychophysical individual* which sleeps and wakes, understands, believes, thinks, desires, feels angry or anxious, sees objects and events, hears music. In a word, it is conceived as *having* experiences, and the *having* of experiences distinguishes it from the purely physical body of Fig. 83.

To say that an organism *has* an experience, or that it is conscious, means that from its own point of view some phenomenon or other is given, that some *A B C D . . . M N O P . . . S T U V W* . . . is presented which can be observed or felt. The distinction between conscious and unconscious conditions of an individual can best be described from this point of view.

To think clearly in psychology it is necessary to distinguish between the purely physical organism and the psychophysical individual. They are not distinct real beings, but they are distinct logical conceptions. It is equally important to distinguish between the environmental field as it is experienced by an individual and the environment of physical energies as conceived by a physicist or by a behavioral psychologist. The two views of the environment are at times very different. For example, the individual's visual field may contain sensory after-images which *as such* have no physical existence.

The Multiple-Aspect View of the Organism and Environment. A comparison of Figs. 83 and 84 makes it clear that the world can be conceived in at least two fundamentally different ways. From the physical standpoint, the objects, events, and relationships of the world are considered *as if* they existed in their own right. "Errors" of observation and the "personal equation" are so far as possible eliminated. From the mental standpoint, the entire world is considered as an existence which depends upon bodily processes within some observing, conscious, biological organism. The psychologist conceives the organism as the basis of perceptions, memories, desires, emotions, and similar individual experiences; he looks to it for an explanation of mental events.

But there are still other points of view. The anatomist, physiolo-

gist, zoologist, regard the organism as a cellular structure with various properties. The physicist views it as a certain mass with characteristic patterns of movement. The chemist views it as a group of chemical substances. The sociologist may talk about the political man, the economic individual, the churchman, the father, etc., thus revealing a variety of attitudes towards the individual.

Some of the points of view which may be taken towards the study of the organism and its environment are represented symbolically in Fig. 85. The inner circle at the left stands for the organism; the outer circle includes the present effective environment and the organism living within it. The arrows stand for different points of view which have been taken by men of science towards the organ-

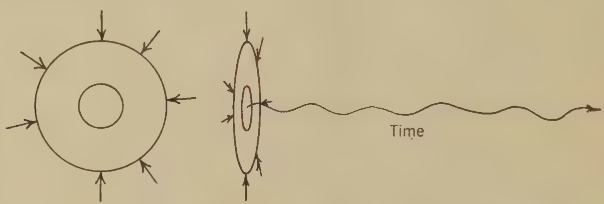

Fig. 85. Graphic Representation of the Multiple-Aspect Hypothesis.

The inner circle at the left represents the organism embedded within its present effective environment; the outer circle includes both organism and environment. The arrows symbolize different points of view assumed by observers. At the right the first representation is seen in perspective and a time line has been added. (*This drawing was suggested to the author by Wilson McTeer.*)

ism and its environment—psychological, anatomical, physiological, physical, chemical, social, and so on.

The organism exists in time; it has a birth, a life, a death. The passing of time is pictured by a waving line at the right of Fig. 85. Almost all points of view take account of the temporal changes. Hence we have a genetic psychology, a developmental anatomy, the physiology of growth. Some standpoints are primarily temporal; this is the case, for example, with embryology and with child psychology.

The picture portrays the multiple-aspect view of the organism and its environment. The figure could readily be extended to include other coexisting or previously existing organisms. If this were done, the further standpoints of differential psychology, social psychology, and many others, could be more adequately represented.

A Basic Aim. One aim which we recognize as fundamental is to formulate psychological principles so that their validity does not depend upon any particular point of view. At the start of this book the writer designated his own bias as *attitudinal*. This bias is little more than the frank recognition of the *status quo*. There are various attitudes or points of view taken up by psychologists towards psychological events. Each standpoint gives its own picture.

We want to build up a scientific psychology which takes adequate account of all the facts of behavior and of individual experience, and which will not be limited by any single point of view. To construct such a science we must frankly recognize that every observation is relative to some individual observer. The observer's *attitude* determines at least in part what he observes and reports.

The integration of the science of psychology, we believe, will not come through an arbitrary blindness to any great source of factual material by fixed adherence to a predetermined and limited point of view. Unity will be achieved gradually through an analytical study of all the pertinent facts of observation in their natural context, and with due regard for the observer's attitude.

The Hypothesis of a Physical Mind. If we bring together the main characteristics of the relatively stable mind which is assumed by the enlightened layman of psychology, we have the following picture. The mind can retain and recall past experiences provided they have not been lost through forgetting; the mind can become set or determined to carry out some purpose of its own or to maintain an attitude; the mind is capable of exhibiting expectancy, readiness, or preparatory adjustment for some impending event; the mind can solve problems, reflect, invent; the mind desires, wishes, wills, but its intentions are frequently in conflict with one another and with the outer world; the mind dreams, goes into reverie, it "wanders" or is "concentrated"; the mind contains attitudes, viewpoints, biases, prejudices, and the like; it determines the pattern of conscious experience as well as the plan of behavior. Finally, the mind is a relatively stable existence quite apart from conscious experience in the sense that a determination remains unconsciously within the mind for a week or perhaps a year, persisting despite dreamless sleep, anesthesia, and traveling from place to place with the body.

Now most, if not all, of the above attributes of the mind are known to be characteristics of brain action. The brain can be modified through activity and use; it can retain a modification; it can become set or determined; it travels with the rest of the body; it is not destroyed by sleep and anesthesia but has a certain permanence; it is the seat of conflicts and adjustments, etc. Point for point, the properties of the mind turn out to be identical with known properties of the brain.

We hold to the theory that the mind and the brain are one and the same reality. All the facts about motivation, as we have reviewed them in this book, fit this identity hypothesis. Whether the structure which regulates behavior and conscious experience be called a *mind* or a *brain* matters little provided we are clear about viewpoints. The main difference between the conceptions of mind and brain is that the former is assumed from an *individual* point of view, and the latter from an *objective*.

The single basic reality we designate as a *physical mind*. The words "individual" and "personality" can also be used in this sense, without departing very far from current usage.

The structural organization of the physical mind can best be described in terms which refer to the environmental field. For example, the determination "to take a trip to Chicago" is generally described in words which refer to the outer world rather than by describing neurons and neural patterns. Although the monistic hypothesis leads to the assumption that such a determination is *physical*, in the sense that it is a *neural determination which regulates energy expenditure and the pattern of behavior*, still it can be described in words or other symbols much better than in neural terms. Even a *complete* neurological description would miss the environmental reference.

This view of the mind fits in well with the common conception, for we ordinarily describe mental organization in terms of meaning. One's set, purpose, or aim, is a *meaningful* determination which can best be described by reference to the environment. But the determination itself is *physical* because it does control the pattern of bodily movement.

Fundamental Principles of Motivation. All the motivating factors considered in this book can be related to a few fundamental conceptions, which will be considered below.

The basic conception is that motivation is a process of arousing movement by physical energy transformations which are concurrent with behavior. Stimuli, from the environment and from the tissues, excite receptors and nerves; the nerve cells excite the muscles. From first to last, this process is a physical one, and the scientific description of it excludes such conceptions as *libido*, vital, and psychic forces unless they be identified with physical processes.

While taking a stand upon a strictly physical view of energetics, we are forced to notice that a conscious purpose, a desire, a goal orientation, or a voluntary determination regulates the pattern of behavior. To be specific, my purpose to go down town leads me to open the garage door and start the auto. Just how such a determination can operate is a central problem for the student of motivation. We have assumed that the determination is within a *physical mind* which regulates and controls the energy expenditures of the organism.

The conception that behavior is regulated through neural organization is another fundamental one. Just as a sieve regulates the course of water which runs through it without itself causing the flow, so neural organization regulates the course of behavior without itself inciting movement. We have maintained that latent organization of the physical mind, with all its complexity, operates in this way. To be concrete, consider those bits of neural organization acquired in the grammar school which make it possible right now to solve problems in addition, subtraction, multiplication, and division. At present this organization is latent; it produces no energy expenditure. But if I ask you, "How much is six times four?" some of this organization comes into play. It regulates behavior in the sense that a sieve determines the course of water, or that a track determines the course of a train. It limits or restricts; it provides the essential conditions for the performance of saying, "Twenty-four."

But the question "How much is six times four?" itself started something going. It energized behavior. It motivated in a way that the latent organization did not. A distinction must be drawn between the *passive* and the *active* form of organization; the former does not energize, the latter does.

It is still problematical whether a sharp line of distinction can be drawn between passive and active forms of organization. There are all gradations of activity from zero to maximum. At one extreme

are the purposive determinations, postural adjustments, goal sets (whether induced by verbal suggestion or by non-verbal conditions) which *actively* determine behavior. At the other extreme are the patterns of latent neural organization which make up our idle habit systems, which comprise our sleeping attitudes, and which form the basis for the whole world of past experience so far as any trace of it is retained. Between these extremes are the general preparatory adjustments, the vague expectations of some kind of event, the recent or vivid experiences which perseverate for a while just as if they were expending intrinsic energy or releasing mental tension.

Neural organization, whether of the passive or the active variety, is built up gradually during the course of a lifetime. Just how this organization is acquired, how it is modified, how it regulates present performance, is in good part the story of learning. We have seen how the effects of reaction—pleasantness and unpleasantness, success and failure—operate in the building up of neural organization. But the law of effect is only one principle of learning among others.

We have not placed psychological hedonism among the fundamental principles of motivation. The affective experiences are ultimate data of psychology, as are also conscious purposes, desires, and the volitional consciousness. Pleasantness and unpleasantness are not physical energies, so far as we know; they are parts of individual experience. Hence we have regarded these feelings as *symptoms* of the dynamic interplay of motives rather than as motivating factors.

In discussing hedonism, we described a doctrine of factual or empirical hedonism. This view is simply the statement that, in general, unpleasantness is associated with *getting away from*, and pleasantness with *keeping*, the conditions which evoke it. This relationship is manifest in interests, in cravings and aversions, and in simple likings and dislikings. Factual hedonism holds to a *process* view of human experience and behavior. Pleasantness and unpleasantness are *processes* within the individual's experience, which can be reported and studied in relation to other *processes* both within and without the body of the subject. Factual hedonism is not a theory of motivation, but it implies a general theory. For one thing, the view sets aside the conceptions of energy, drive, causation, and other dynamic principles.

If causation be ruled out of motivational psychology, the whole

study becomes one which deals with interrelationships among observed natural processes. All the facts and problems discussed in this book can be handled in a non-causal, matter-of-fact way. The elimination of causation from the study of motivation leaves a purely descriptive science, coextensive with psychology itself, which operates in terms of events and their conditions.

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27. Vernon, P. E., and Allport, G. W. A test for personal values. *J. Abn. & Soc. Psychol.,* 1931, 26, 231-248.

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30. Conklin, E. S. *Principles of abnormal psychology.* New York: Holt, 1927. Pp. x + 457.

31. Dorcus, R. M., and Shaffer, G. W. *Textbook of abnormal psychology.* Baltimore: Williams and Wilkins, 1934. Pp. xiv + 389.

32. Fisher, V. E. *An introduction to abnormal psychology.* New York: Macmillan, 1929. Pp. xii + 512.

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36. Hamilton, G. V. *An introduction to objective psychopathology.* St. Louis: C. V. Mosby, 1925. Pp. 354.
37. Hart, B. *The psychology of insanity.* New York: Macmillan, 1923. Pp. xi + 176.
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40. Hollingworth, H. L. *The psychology of the functional neuroses.* New York: Appleton, 1920. Pp. xiv + 259.
41. McDougall, W. *Outline of abnormal psychology.* New York: Scribner, 1926. Pp. xvi + 572.
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46. Taylor, W. S. *Readings in abnormal psychology and mental hygiene.* New York: Appleton, 1926. Pp. xxxiv + 789.
47. Wallin, J. E. W. *Clinical and abnormal psychology, a textbook for educators, psychologists and mental hygiene workers.* Boston: Houghton Mifflin, 1927. Pp. xxii + 649.

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48. Boring, E. G. *A history of experimental psychology.* New York: Century, 1929. Pp. xvi + 699.
49. Heidbreder, E. *Seven psychologies.* New York: Century, 1933. Pp. viii + 450.
50. Murchison, C. *Psychologies of 1925.* Worcester, Mass.: Clark Univ. Press, 1926. (2nd ed.) Pp. 6 p. l. + 412.
51. Murchison, C. *Psychologies of 1930.* Worcester, Mass.: Clark Univ. Press, 1930. Pp. xiii + 497.
52. Murphy, G. *An historical introduction to modern psychology.* New York: Harcourt, Brace and Co., 1932. (3rd ed.). Pp. xx + 471.

53. Weld, H. P. *Psychology as science, its problems and points of view.* New York: Holt, 1928. Pp. xi + 297.

54. Woodworth, R. S. *Contemporary schools of psychology.* New York: Ronald Press, 1931. Pp. vi + 232.

From the numerous **textbooks of psychology** the following have been selected as representatives of different points of view. If studied collectively, they will give the student a comprehensive understanding of the principles of contemporary psychology.

55. Boring, E. G., Langfeld, H. S., Weld, H. P., and collaborators. *Psychology, a factual textbook.* New York: Wiley and Sons, 1935. Pp. xviii + 555.

56. Dashiell, J. F. *Fundamentals of objective psychology.* Boston: Houghton Mifflin, 1928. Pp. xviii + 588.

57. Garrett, H. E. *Great experiments in psychology.* New York: Century, 1930. Pp. xvii + 337.

58. Koffka, K. *Principles of Gestalt psychology.* New York: Harcourt, Brace and Co., 1935. Pp. xii + 720. (This excellent presentation of Gestalt psychology appeared after the present manuscript was completed. It should be seen by every student who desires to understand the Gestalt movement within psychology.)

59. McDougall, W. *The energies of men, a study of the fundamentals of dynamic psychology.* New York: Scribner, 1933. Pp. xii + 395.

60. Watson, J. B. *Psychology from the standpoint of a behaviorist.* Philadelphia: Lippincott, 1929. (3rd ed.) Pp. xvii + 458.

61. Woodworth, R. S. *Psychology.* New York: Holt, 1934. (3rd ed.) Pp. xiv + 546.

QUESTIONS AND EXERCISES

QUESTIONS AND EXERCISES

These questions and exercises are designed to aid the student in study and review of the materials in the different chapters. A good general exercise is to outline a chapter, so as to bring out clearly the main facts and significant principles.

CHAPTER I

THE PROBLEM

1. From your own experience describe several situations of practical life which call for an understanding of the motivation of behavior.

2. What is the difference between school work which is adequately motivated and that which is not?

3. What motivating factors account for Kitson's result in the work with typesetters? Was added motivation injurious to the health of the workers?

4. What is a phobia? an inferiority complex? a sense of religious duty?

5. What are motivational increments and decrements? Illustrate.

6. Define the problem of motivation within psychology.

7. What is meant by the *explanation* of behavior?

CHAPTER II

THE ENERGETICS OF ACTIVITY

1. What is meant by "spontaneous activity?" Does the concept have a place in scientific psychology?

2. Upon what factors does the activity level depend?

3. Can a doctrine of mental energy be formulated so that there are no objections to it?

4. What are the current meanings of drive? How can drive and incentive be distinguished?

5. Distinguish *drive* from *drives*.

6. In view of the discussion upon homeostasis, what is the difference between bodily need and desire?

CHAPTER III

ANIMAL DRIVES

1. Why should the motivation of animals be studied?

2. Reproduce from memory the classification of methods for studying animal motivation. Can you suggest any improvements upon the classification?

3. Devise and outline an experiment, apart from those mentioned in the text, using the counterbalance of motives method.

4. Devise and outline an experiment, using the learning method.

5. What bodily processes are typical of hunger? By what methods have they been investigated?

6. Summarize in your own words the behavioral facts of: (*a*) free-choice feeding experiments, (*b*) special cravings and aversions, (*c*) food preferences, (*d*) food deprivation in relation to activity, and (*e*) in relation to learning, (*f*) hunger in relation to pain avoidance. What is the significance of these behavioral facts for a general theory of food ingestion?

7. Describe in detail the bodily mechanism which regulates water-seeking behavior.

8. What partial activities are involved in maternal behavior of the rat? Contrast with human maternal behavior.

9. What are the essential differences between masculine and feminine behavior in the rat? How can these differences be explained?

10. Make a list of the fundamental human drives.

CHAPTER IV

DRIVE AND PURPOSE

1. In view of the discussion upon the bodily and environmental determinants of activity, give a definition of *drive*.

2. Can a single drive, such as thirst, be differentiated sharply from all others? Explain.

3. Can drives be arranged in an hierarchy from the most dominant to the least potent? Explain.

4. What is an inclination? A mood? Upon what do inclinations and moods depend?

5. What formulations of the instinct doctrine are scientifically sound? What difficulties and dangers are there with this doctrine? Upon what basis can agreement be reached?

6. Are all prolonged purposive activities acquired through a process of learning? Discuss pro and con.

7. State Hull's goal gradient hypothesis, reviewing the experimental evidence upon which it rests.

8. What can be said scientifically about the general view that a conscious purpose motivates behavior?

CHAPTER V

DIRECTION AND REGULATION

1. Give original examples to show how bodily posture directs the course of behavior.

2. Analyze the delayed reaction to show what fundamental psychological principles are involved.

3. What is the difference between neural organization and dynamic determination? Illustrate by reference to a thoroughly learned pathway from one place to another.

4. Describe the experiments upon organic set. What light do they shed upon the nature of determining mechanisms?

5. What did Bills and Brown mean by "quantitative set"? Devise an experiment upon this problem.

6. What distinction, if any, would you draw between *mental* organization and *neural* organization? between *mental* set and *neural* set?

7. Define "attitude," and explain how "attitudes" can be measured.

8. Define and distinguish: want, desire, craving. How are these conceptions related to others of the chapter?

9. What factors should be listed under the heading "Adjustment of the Subject to His Task"?

10. If we postulate motives to explain behavior and then explain motives physiologically, why not explain behavior directly in physiological terms and give up the concept of motive?

CHAPTER VI

POSITIVE AND NEGATIVE BEHAVIOR

1. What relation exists between the conceptions of positive-negative behavior and beneception-nociception?

2. Is it possible to distinguish appetite from aversion if the environmental object be left out of the picture? Explain your answer.

3. Can Tolman's list of appetites and aversions be defended on a purely physiological basis, as well as on a behavioral basis?

4. What is punishment, psychologically considered? What are its principal effects upon behavior?

5. How would you apply the Yerkes-Dodson principle to the training of a child?

6. How is the concept of reward related to that of animal drive? What is the relation between reward and stimulus?

7. In what ways have rewards been varied in experiments upon animal motivation?

8. Distinguish between latent and transient learning, and explain the phenomena.

9. How did reward and punishment differ in Hamilton's experiment (pp. 310-314)?

10. What does Sharp's experiment show about the relation between motivation and learning? Does unmotivated learning ever occur?

CHAPTER VII

PSYCHOLOGICAL HEDONISM

1. Discuss pro and con the view that we seek pleasant and avoid unpleasant feeling, citing experimental evidence. What motivates going to a movie? Is it conscious and deliberate pleasure-seeking?

2. Does doing something "because it is interesting" presuppose hedonistic motivation? What is the psychological significance of changes of interest with age?

3. State the law of effect, and give your opinion concerning it.

4. What is an evaluative disposition? Illustrate.

5. Describe briefly the leading views concerning the nature of felt experience. State the author's *attitudinal* view of the problem.

6. What is an affective reaction? Review the experimental evidence upon which the conception is based.

7. Are there any innate likes and dislikes? Justify your answer.

8. What relationships exist between pleasant and unpleasant feeling and peripheral processes? Summarize the facts.

9. Describe some of the mental conditions which determine pleasant and unpleasant feeling. Give illustrations from your own experience.

10. Describe the more important methods of studying preferential discrimination with human subjects.

CHAPTER VIII

SOCIAL MOTIVATION

1. Is prestige motivation always based upon some more fundamental biological motivation? Justify your answer.

2. Cite a specific instance in your own life or in that of a friend where a sense of inferiority has been the main factor.

3. Summarize Allport's findings regarding the effect of a co-working group upon performance.

4. Why did the presence of a group affect stutterers differently from non-stutterers?

5. How do individuals differ in their reactions to a competitive situation? Explain these differences.

6. What does the experimental evidence show regarding the relative effectiveness of working for one's self *versus* working for one's group? What light does this shed upon the nature of altruism?

7. What precautions should a teacher take in praising her pupils for their work?

8. Is the continued use of praise superior to that of reproof as an incentive to learning? What psychological explanation can you give for your answer?

9. Define ideomotor action. Give an original illustration of this kind of activity; explain its mechanism.

10. Describe in detail the process of suggestion, and illustrate.

11. Give a precise account of the process of imitation, and illustrate.

12. List the determinants of belief. Explain how belief is related to doubt from the psychological point of view.

CHAPTER IX

EMOTION AND MOTIVATION

1. Define emotion. What fundamental points of view may be taken toward the study of emotional processes?

2. Why have different classifications of the emotions heretofore failed to agree?

3. Describe the experiments of Sherman and Landis showing their relation to the problem of defining and classifying emotions.

4. State, in your own words, Darwin's three principles of emotional expression.

5. What internal bodily processes probably occurred in John Coulter during the remarkable race for his life?

6. What bodily structures are excited by the autonomic nervous system? Describe in detail the relationship of the cranial and sacral divisions to the sympathetic. What are the main functions of each division?

7. What is the rôle of the thalamus in emotional excitement?

8. Describe the more important glandular and visceral changes which occur during fear and anger.

9. Cite what evidence you can from experiment and from daily life to support the view that emotions are disruptive.

10. It is commonly said that when an individual is emotionally aroused about some course of action he is more vigorous and persistent in carrying it out than when he is emotionally indifferent. What psychological truth is implied in the statement?

CHAPTER X

THE DYNAMIC INTERPLAY OF MOTIVES

1. Describe the physical and physiological bases of conflict. In what respects does one conflict differ from another?

2. Present an outline of the types of adjustment which an individual may make when thwarted by a situation.

3. What are the main methods used by psychologists today for investigating mental structure?

4. What do you think about the writer's claim that the principles of psychology must be formulated so that their validity is independent of any particular viewpoint?

5. Distinguish clearly between the physical conception of the organism and that of the experiencing individual.

6. What is the "multiple-aspect" hypothesis?

7. If one holds to a purely descriptive viewpoint, does one need a doctrine of drive?

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